CHAPTER - 6

EVALUATION AND ANALYSIS OF ALTERNATIVE TECHNOLOGIES

INTRODUCTION

The ~~investment, operating costs and revenue of the~~ alternative technologies have been evaluated in this chapter by using the Discounting Cash Flow (DCF) method. The criteria of choice viz. the Present Value Costs (PVC), Net Present Value (NPV), Present Value Cost per unit output(PVC/unit) and Capital-Labour (K/L) ratio were used to rank the Spinning unit (Stage I+II+RF) and then the complete process technologies (Stage I to IV). The findings would then be analysed to identify the optimum technology within the modern, intermediate and from the entire spectrum of alternative technologies. The analysis would consider the realtive effeciency in terms of investment and unit costs, generation of surplus and employment level of the alternative technologies. Emphasis would be on the trade-off between employment generation and effeciency. The employment elasticity of PVC and NPV would be assessed and then examined as to whether such trade-off is possible. It has been observed that the investment and the operating costs and the revenue were determined on the basis of the market prices which may not reflect true or opportunity costs of factor inputs. Under such circumstances , the financial analysis may not be adequate to rank the technologies and the ranking established earlier may differ. Finally, sensitivity of the ranking in the form of effeciency pricing of factor inputs have been done to examine the ranking established in the financial analysis.However,the price adjustments were only made for major factor inputs i.e capital and labour.

Evaluation of Technologies

As the investment , operating costs and revenue of the alternative technologies have been ascertained on the basis of 1981 market prices , their ranking and evaluation founded on financial approach or private profitability may be questioned when the market prices are distorted or do not reflect the true or opportunity costs of factor inputs. Sensitivity analysis , where the prices of the two main factor inputs viz.

capital and labour would be adjusted for selective technologies , would help to encounter such criticism. The ranking of the technologies would be done both during the financial analysis and after the adjustment of the factor prices so that any change may be taken into account. If, the ranking does remain unchanged due to the factor price adjustments than the distortion of factor price is not significant to alter the conclusion drawn from the financial analysis.

The ranking of technologies have been based on Discounted Cash Flow (DCF) method and the criteria of choice developed in Chapter-4,viz. Present Value Cost (PVC),Net Present Value (NPV) and Present Value Cost per unit output (PVC/unit output). A fourth criterion of choice would also be formed by calculating the capital-labour ratio (K/L) of the alternative technologies. This would be done by using the invested capital and the employment level generated by the technologies. This criterion would help to analyse the criteria already established and indicate the investment intensity of the alternative techno logies.The equations derived for the PVC, NPV and the PVC/unit output in Chapter -4 would be used, but they, however, have been translated into 'Computer Programme' to make it easier to handle the voluminous calculation (See appendix 7.1)

The cost of capital to be employed in the evaluation of the aternatives is important as distortion of such costs or under valued interest rates for the industrial projects are widespread in the developing countries. This hinders the assessment of the true or opportunity costs of capital. Although, it is customary to use 10 per cent capital costs for project analysis, however , a number of discount rates would be used to evaluate the alternatives in order to counteract any variation or distortion of capital costs and also to indicate the sensitivity of the capital costs to profitability. In 1981, the interest rate of the Bangladesh Bank (The State Bank) was 10.5 per cent, while for industrial finance,the interest rate charged by the the investment banks was 14 per cent. The appraisal of the

public sector projects conducted by the Planning Commission of Bangladesh have used two discount rates of 10 and 15 per cent . The Textile Mills Corporation used identical capital costs to examine the feasibility of the projects. The present study would use three discount rates which are 10, 15 and 20 per cent.

The evaluation of the alternative technologies would be done as already mentioned for expected and the estimated actual productivity levels. The emphasis of the analysis would be on the estimated actual level. However, results for the expected productivity level would also be presented and the variations in PVC, NPV and the PVC/unit output would be discussed. The twelve alternative technologies identified in this study combine groups of sub-processes from the modern, intermediate and traditional technologies. It is essential to establish the optimum modern spinning technology which could tne be combined with the intermediate (Service Centre) and the traditional (handloom) technologies. Therefore, first of all an attempt would be made to identify the optimum spinning technology and then proceed to co nsider the complete process alternatives.

Ranking of Alternative Spinning Technologies

Although the twelve alteraative technologies are complete textile processes (Stages I to IV) i.e combine spinning and weaving, however it would be essential to examine Spinning (Stage I+II+RF) separately due to the need to :-

a combine optimum spinning technology in the modern sector with the Service Centre or Handloom weaving, all the four sources of technologies are required to be evaluated,

b examine the ranking between modern and intermed ate spinning technologies.

In (a), the spinning technologies of UK, Japan, India and

Rumania would be examined and the optimum technology obtained i.e with the least PVC or higher NPV or the least PVC/unit output would be chosen to be combined with the Service Centre and the Handloom weaving. While in(b), the ranking of the technology sources mentioned for modern spinning, ATDA pedal , RFC power and the KVIC hand-spinning technologies would be examined. Such ranking would show the variation in costs, profitability and employment level of the alternative spinning technologies. Evaluation and the ranking of the technologies would be carried out for the estimated actual and expected productivity levels with emphasis on the former.

Ranking of the Spinning Technologies for Actual Productivity Level

The ranking of the technologies have been based on the PVC,NPV and the PVC/per unit output. It is obvious that the technology with the least PVC would attain the higher NPV and entail less unit cost. In other words, the ranking would not change for either criteria. Nevertheless, the ranking by all these criteria have been established and the emphasis of the analysis had been on the employment generated by the alternative technologies. The capital-labour ratio of the alternatives have also been taken into consideration.

PVC and the K/L Ratio of the Alternative Spinning Technologies

Present Value Costs (PVC)

The ranking of the alternative sources of modern technology and the ATDA pedal, RFC power and the KVIC hand-spinning have been given in table 7.1. The least PVC spinning technology have been placed at the top and then the ranks have been progressively increased with the increase in PVC. The table shows that the Indian technology is the least cost among the modern and the intermediate. It is also evident that all the alternative sources of modern technologies have been ranked as being more effecient than the intermediate spinning technologies. Among intermediate technologies, the RFC power has emerged as the most effecient than the ATDA Pedal and KVIC hand-spinning technologies.

TABLE 7.1

PRESENT VALUE COST(PVC) OF ALTERNATIVE SPINNING TECHNOLOGIES

AT ESTIMATED ACTUAL PRODUCTIVITY

(In Million Taka)

Technologies	Ranking	Total Capital Cost (K)	Employment(L) ('000)	Capital /Labour (K/L) ('000)	PVC at Discount Rates 10%	15%	20%	PVC in Excess of L.C.at 15 per cent	Increase in (L) Over L.C Spinning	Cost/ Additional job Compared to L.C('000 Tk)
Modern										
INDIAN(L.C) 1/	I	213.20	1,008	211.50	884.84	607.22	444.28	-	-	-
RUMANIAN(S.B) 2/	II	218.78	1,046	209.16	887.71	610.06	446.96	2.84	38	74.74
JAPANESE	III	251.27	986	254.84	904.42	626.27	462.10	19.05	(22) 3/	
U.K	IV	274.67	972	282.58	935.63	650.97	481.15	43.75	(36)	
Intermediate										
RFC Power Spg.	V	244.98	5,288	46.33	1,075.90	723.48	518.84	116.26	4,280	27.16
ATDA Pedal Spg.	VI	265.53	12,268	12.27	1,202.79	803.80	572.84	196.58	11,260	17.46
KVIC Hand	VII	477.93	35,040	13.64	1,737.47	1,187.20	865.68	579.98	34,032	17.04

Note: 1/L.C : Least Cost Spinning Technology
2/S.B : Second Best Spinning Technology
3/( ) : Figures in bracket are negatives.

The ranking of the technologies have been found to be unaffected by the change in capital cost and therefore the ensuing discussion would be based on single capital cost which is 15 per cent discount rate.

The Indian spinning technology has the least cost of Tk.607.22 million followed by the Rumanian, Japanese and the UK with the least cost of Tk.610.06m, Tk.626.27m and Tk.650.97 million respectively. The Indian PVC is about 0.5, 3.04 and 6.72 less than the corresponding technologies of alternative sources. In compared to the RFC power, ATDA pedal and the KVIC hand-spinning , its PVC falls by 16.07, 24.45 and 48.85 per cent respectively. It appears that the second best technology, the Rumanian spinning has marginally higher PVC, while the KVIC hand-spinning has almost twice the PVC of the least cost technology.

Capital-Labour (K/L) Ratio

Table 7.1 shows the capital-labour ratio of the alternative sources of spinning technologies the ranking of which does not correspond with the PVC rankings. It shows that the second best technology has the lowest capital cost per employment of Tk.209.16 thousand followed by the least cost Indian technology with Tk.211.50 thousand. The differential of the K/L ratio is very small i.e the K/L ratio of the least-cost technology increased only by 1.1 per cent than Rumanian spinning. The ranking of the capital-labour ratios of the other technologies corresponds with the PVC rankings, however their variations in the K/L ratio are significant, for instance the capital-labour ratio of the Japanese and the UK technologies is about 17.0 and 25.15 per cent higher than that of the least cost technology. It emerges that within the modern spinning technologies , the capital intensity of the Rumanian and the Indian technologies are almost identical, while the Japanese and the UK are relatively more capital intensive.

The difference of the K/L ratio widens further for the intermediate technology spectrum. The capital-labour ratio of the RFC power, the ATDA pedal and the KVIC technologies are Tk.46.33, Tk.21.65 and Tk.13.64 thousand respectively. The K/L ratio of the least-cost technology is 4.56, 9.76 and 15.50 times higher than the RFC Power, AATDA Pedal and the KVIC hand-spinning technology respectively.

Employment Level and Expansion

An attempt has been made here to examine the employment level and the possiblity of trade-off between employment and effeciency among the alternative spinning technologies. Table 7.1 shows the employment level of the modern and the intermediate technologies . It appears that the Rumanian technology provides the highest employment of 1,048 followed by the Indian, Japanese and the UK of 1,008, 986 and 972 respectively. The variation in employment generation is not so significant for alternative sources of modern technology. Rumania provides about 3.76 per cent more than the least cost technology, while the Japanese and the UK generates about 2.18 and 3.57 per cent less. However, these variations are more pronounced for intermediate technologies. The RFC power, ATDA pedal and the KVIC hand-spinning creates employment of 5,288, 12,268 and 35,040 respectively, therefore provides 5.25, 12.17 and 34.76 times more employment than the least cost technology.

The trade-off between employment and effeciency have been analysed by calculating the PVC in excess of minimum and the increase in employment over the least cost technology. Table Table 7.1 gives the cost of additional jobs created compared to the least cost technology. It has been done only for the

discount rate 15 per cent, as the ranking which would be established for the cost of additional jobs created would not alter. However, the absolute magnitude i.e the cost of additional jobs would vary at different discount rates. The cost of additional jobs created by the Rumanian technology at 15 per cent capital cost is Tk.74.74 thousand,while,at 10 and 20 per cent they are Tk.75.52 and Tk.70.53 thousand respectively. It shows that the cost of additional jobs decreases with the increase in capital cost which applies for other alternatives. The Japanese and the UK technologies have higher PVCs than the least-cost, while at the same time generate less employment and, therefore, in terms of employment expansion these technologies are not worth considering. 1/

In terms of employment expansion, the KVIC hand-spinning provides the most attractive option as it requires the lowest cost of Tk.17,04 thousand per additional jobs than the least cost technology. The cost differential for the creation of additional jobs between the KVIC hand and the ATDA pedal spinning is very marginal, i.e the latter costs only 2.45 per cent more per additional job created. The RFC power and the Rumanian spinning requires Tk.27.16 and Tk.74.74 thousand to create additional jobs compared to the least cost technology. While the costs required by the KVIC hand-spinning are about 1.59 and 4.38 times more respectively, than these technologies.

Although the KVIC hand-spinning appears to be an attractive option, but its PVC is higher than the minimum and represents 95 per cent of the least cost option PVC. The PVC in excess of the minimum is Tk.579.98million and is about three times the investment cost of the least cost spinning technology. Therefore , the most labour intensive technology is not worth considering as an option. The trade-off could be improved by considering the RFC power and the ATDA pedal spinning. Of these two, the PVC in excess of minimum of the RFC power and the ATDA pedal spinning are Tk.116.26 and Tk.196.58 million

1/ However,these technologies are technically efficient and could be represented by an isoquant.But,the other(Cont.P/9).

respectively. This shows that the PVC in excess of minimum of the RFC power is about 19 per cent of the PVC and about 54.5 per cent of the investment cost of the least cost technology. While the ATDA pedal/spinning has PVC in excess of minimum of about 32.4 per cent of the PVC and about 92 per cent of the investment costs. Of these two, the RFC power spinning is a better option. The employment elasticity of PVC of these technologies which have been calculated for the KVIC, ATDA pedal and the RFC power spinning are 35.35, 34.58 and 22.23 respectively. Which means that 1 per cent increase in the PVC brings forth a relative increase/in employment of 35.35, 34.58 and 22.23 per cent respectively by these technologies. This further emphasises that between the KVIC hand and the ATDA pedal spinning, the choice of effeciency is marginal. The arguments put forward earlier as regards the PVC in excess of minimum of these technologies when compared to the PVC and the Investment of the least cost, the KVIC hand and the ATDA pedal spinning prove to be unworthy options, while, the RFC power spinning appears to be a better choice among the intermediate technologies.

On the other hand, the second best option i.e the Rumanian spinning technology could also be examined for its acceptability. Here the PVC in excess of the minimum is Tk.2.84 million which is about 0.5 per cent of the least cost option PVC and about 1.3 per cent of its initial investment cost. But the total additional employment offered by the second best option is only 38. This appears to be a marginal contribution to the employment expansion objective with a 3.8 per cent increase on the original employment of the least cost option, while the PVC has increased by 0.5 per cent. The employment elasticity of the PVC is 8.17, which shows that 1 per cent increase in the PVC will relatively yield a 8.17 per cent in employment which is a favourable trade-off. Thus the second best choice may/pose an attractive alternative of increased employment than the least cost option.

1/ (Cont.) alternatives which are considered for employment expansion would appear to be technically inefficient as both employment and investment cost increases (See for further discussion, Employment Level and Expansinon of Employment of Composite Units).

Net Present Values (NPV) of the Alternative Spinning Technologies

The NPV of the alternative sources of spinning technologies have been calculated from the annual revenue estimated in Chapter-6. Table 7.2 shows the NPV at three different discount rates of 10, 15 and 20 per cent for alternative sources of modern spinning, RFC power, ATDA pedal and the KVIC technologies. The ranking of the NPV has been done identically as for the PVC and has remained unaltered i.e least cost or the Indian emerges as the most effecient spinning technology among the modern and the intermediate alternatives.

The table shows that at 10 per cent capital cost , the the effecient technologies are the Indian, Rumanian and the Japanese with positive NPVs of Tk.21.59m, Tk.18.8m and Tk.2.35 million respectively. The UK and the other intermediate technologies are ineffecient with large negative NPVs. At 15 and 20 per cent capital costs,all the alternative technologies are ineffecient including the least-cost. NPVs at 15 per cent capital cost have been chosen to compare the technologies. The loss in NPVs of the least-cost(Indian) and the second-best (Rumanian) are Tk.26.09m and Tk.28.90million respectively,which shows that the variation in the NPVs is relatively less than other modern technologies i.e 9.72 per cent. Whereas the loss in NPVs of the Japanese and the UK technologies are Tk.45.02m and Tk.69.68m respectively which indicates an increase of 1.72 and 2.67 times than the least-cost technology. The loss in the NPVs become further pronounced when the intermediate spinning technologies are considered. of the RFC power, ATDA pedal and the KVIC hand-spinning are Tk.143.08m , Tk.223.30m and Tk.604.08million respectively. Compared to the least-cost technology, the loss in the NPV of the RFC, ATDA and the KVIC hand-spinning technologies are 5.48, 8.55 and 23.15 times more respectively.

TABLE 7.2

NET PRESENT VALUES(NPV) OF ALTERNATIVE SPINNING TECHNOLOGIES AT ESTIMATED ACTUAL PRODUCTIVITY

(In Million Taka)

Technologies	Ranking	Total Capital Cost (K)	Employment(L) ('000)	Capital /Labour (K/L) ('000)	NPV at Discount Rates 10%	15%	20%	NPV in Excess of L.C.at 15 per cent	Increase in (L) Over L.C Spinning	Cost/ Additional job Compared to L.C('000 Tk)
Modern										
INDIAN(L.C) 1/	I	213.20	1.008	211.50	21.59	(26.09) 3/	(47.05)	-	-	-
RUMANIAN(S.B) 2/	II	218.78	1,046	209.16	18.80	(28.90)	(49.72)	2.81	38	73.95
JAPANESE	III	251.27	986	254.84	2.35	(45.02)	(64.82)	18.93	(22)	
U.K	IV	274.67	972	282.58	(29.80)	(69.68)	(84.64)	43.59	(36)	
Intermediate										
RFC Power Spg.	V	244.98	5,288	46.33	(171.49)	(143.08)	(121.88)	116.99	4,280	27.33
ATDA Pedal Spg.	VI	265.53	12,268	12.27	(298.70)	(223.30)	(175.69)	197.21	11,260	17.51
KVIC Hand Spg.	VII	477.93	35.040	13.64	(826.68)	(604.08)	(467.40)	577.99	34,032	16.98

Note: 1/ L.C : Least Cost Spinning Technology
2/ S.B : Second Best Spinning Technology
3/ ( ) : Figures in bracket are negatives.

The NPV variation with relation to the capital costs shows that the loss in NPV increases with the rise in capital costs. The NPVs for the least-cost technology for example at 10, 15 and 20 per cent capital costs are Tk.21.59million, (Tk.26.09 m) and (Tk.47.05m) respectively, i.e the net loss in NPV at 15 and 20 per cent cost of capital are Tk.47.68 million and Tk.68.64 million respectively. However for the intermediate spinning technologies the loss in the NPVs at 10, 15 and 20 per cent cost of capital are Tk.171.49m, Tk.143.08m and Tk.121.88 million respectively, which means that at 15 and 20 per cent capital cost, there is a net savings in loss of about Tk.28.41 million and Tk.49,61 million respectively. This is because the annual operating costs of the RFC power, ATDA pedal and the KVIC hand-spinning technologies are Tk.144.08m, Tk.163.93m and Tk.222.53million respectively, while thier revenues are Tk.141.11m, Tk.141.00m and Tk.141.00 million respectively (See appendix 6.19). As the net cash flow of these technologies are negative, therefore at higher discount rate the discounted cash flows would be less negative. The sum of these costs and benefits i.e the NPVs would be less at the higher discount rates.

Table 7.2 shows the loss in NPV per additional job created. The results obtained confirms the findings that if employment generation is the objective then the KVIC hand-spinning would create the most employment with the lowest loss in NPV. While the UK, the most capital and the least employment intensive technology followed by the Japanese, are both found to be ineffecient. Again the argument put forward for the PVC analysis stands i.e it is only the second-best technology (Rumanian) which provides a relatively better alternative to the least-cost .

At above 10 per cent cost of capital all the alternative technologies are ineffecient and require subsidy to meet the investment and the recurring costs. The landing rates of the investment banks are 14 per cent and together with service and other expenses on the capital , the cost of capital could be considered as 15 per cent. Therefore , at this capital cost , it appears that the public sector investment on the expansion of the spinning section only to sustain the handloom has been a cost to the economy. It is essential for investment to generate surplus to promote economic growth,i.e the investment should be economically effecient. The results established indicate that the expansion of each spinning unit with 25,000 spindles (the unit size considered for this study) inspite of the machinery source is economically ineffecient and require subsidy from other sectors of the economy. It is obvious therefore , the subsidy has been higher for the Rumanian, Japanese and UK technology sources than the Indian. The findings have established very clearly that the spinning technologies developed in India i.e intermediate technologies are economically much inferior than the modern technology. Among them,only the RFC power spinning is relatively effecient. However, these technologies have the potentiality to bring about large expansion of employment,viz. the RFC power,ATDA pedal and the KVIC hand-spinning provides about 5 ,12 and 35 times more employment respectively than the least-cost technology but at a much higher economic costs.

It is essential to discuss the impact of the yarn price on the NPVs of the alternative sources of spinning technologies. The yarn price used for the count of the yarn has been taken from the BTMC. The fixation of the yarn price is under the direct control of the Government, and the ex-factory price of yarn is identical for all the mills despite of the yarn quality and the mill location. Therefore,

the mills which are at a distance away from the sea-port incur extra costs for transport and other expenditures. Such variation in input costs would be reflected in the unit cost,but the existing yarn price fixed ignores such factors. This study,however, considers the location of units in the central region of the country and minimises the possibility of any cost differentials. The negative NPVs of technologies arise due to low ex-factory yarn prices in relation to their cost of production. It can be said that the fixation of the yarn at a low price could be an indirect policy of the Government to execute its main objective of helping to sustain the handloom weaving and the employment it presently generates, by subsidising the handloom weavers. In other words,the policy to expand the spinning capacity only for the supply of yarn to the handloom weavers at present prices(1981)of yarn is a cost to the economy which affects the economic growth. It would be appropriate here if the yarn price of the particular count used for this study is taken from the Indian price. The ATDA yarn price for 32s cotton count is found to be Tk.31.65 per lb.,which is in fact about 27.72 per cent higher than the Bangladesh ex-factory price. If this yarn price is considered to be the selling price of yarn in Bangladesh, then the profitability of the alternative spinning increases substantially,especially for the modern sector. At that price, all modern spinning alternatives generate surplus,and for example, the profitability of the least-cost technology increases at discount rates of 10 per cent from Tk.26.09 million to Tk.217.93 million, while at 15 and 20 per cent from a loss of NPVs to a surplus of Tk.47.05million to Tk.89.68 million and Tk.47.05 to Tk.24.49 million respectively. On the other hand, the RFC Power spinning from a loss of NPVs of Tk.171.49 million and Tk.143.08 million generates a surplus of Tk.75.09 million and Tk.15.57 million at 10 and 15 percent discount rates,while at 20 per cent,its loss in NPV reduces from Tk.121.88 million to Tk.13.22 million. Although, the loss in NPV of the ATDA Pedal and the KVIC hand-spinning reduces, however, they still incur a substantial loss. At 15 per cent discount rate, for example,the loss reduces from Tk.223.30m to Tk.64.65million and Tk.604.08 million to Tk.445.44 million respectively. Therefore, even at about 28 per cent increase in price,the ATDA Pedal and the KVIC hand-spinning technologies require large subsidies compared to other attractive spinning technologies.

Present Value Cost Per Unit(PVC/Unit)of Alternative Spinning Technologies.

The PVC per unit output (lb.) of yarn has been calculated at different discount rates viz. lo, 15 and 20 per cent. Table 7.3 gives the unit costs for the alternative sources of modern, RFC power, ATDA pedal and the KVIC hand-spinning technologies alonwith the increase in unit costs over the least-cost technology at different discount rates.

For the least-cost technology (Indian), the PVC/unit output at 10, 15 and 20 per cent capital cost are Tk.7.88, Tk.5.40 and Tk.3.95 respectively. The unit cost decreases with higher cost of capital and the magnitude of this decrease is 31.5 and 49.88 per cent at 15 and 20 per cent respectively than the unit cost at 10 per cent . This is common to all ather technologies, only the magnitude of the cost differential may vary slightly. The decrease in the PVC/unit output is due to the investment and the operating costs of the technologies being discounted at higher rates while the output remained constant. The increase in unit costs over the least-cost technology at different discount rates shows that the differential in increase rises with the increase in discount rates. The modern technology from the UK source, for instance, at 10 per cent discount rate has a PVC/unit output which is 5.71 per cent higher than the least-cost , while this differential would increase to 7.22 and 8.6 per cent at 15 and 20 per cent discount rates respectively, which also applies in case of other technologies as well. On the other hand for intermediate spinning, the impact is reverse the differential between the least-cost and the intermediate technologies decrease with the increase in the discount rates. At 10 per cent discount rate the differential for KVIC hand-spinning is 96.32 per cent , while at 15 and 20 per cent, the differentials are about 95.74 and 95.19 per cent respectively. However, it has been found that these differentials decrease rapidly for the ATDA pedal and the RFC power

TABLE 7.3

PRESENT VALUE COST PER UNIT(PVC/UNIT) OF ALTERNATIVE SPINNING TECHNOLOGIES AT ESTIMATED ACTUAL PRODUCTIVITY

(In Million Taka)

Technologies	Rank-ing	Total Capital Cost(K)	Annual Operating Cost	PVC/Unit at Discount Rates (In Taka) 10%	15%	20%	Increase of PVC/Unit Over the Least Cost(in Per Cent) 10%	15%	20%
Modern									
INDIAN(LC)1/	I	213.20	113.73	7.88	5.40	3.95	-	-	-
RUMANIAN(SB)2/	II	218.78	113.53	7.90	5.43	3.98	0.25	0.56	0.76
JAPANESE	III	251.27	112.48	8.05	5.57	4.11	2.16	3.15	4.05
U.K	IV	274.67	114.74	8.33	5.79	4.29	5.71	7.22	8.60
Intermediate									
RFC Power Spg.	V	244.98	144.08	9.58	6.44	4.62	21.57	19.26	16.96
ATDA Pedal Spg.	VI	265.53	163.93	10.71	7.16	5.10	35.91	32.59	29.11
KVIC Hand Spg.	VII	477.93	222.53	15.47	10.57	7.71	96.32	95.74	95.19

Note: 1/ L.C : Least Cost Spinning Technology
2/ S.B : Second Best Spinning Technology

than the KVIC hand-spinning. The reverse impact is due to the relatively high annual operating costs flow than the initial investment outlays which have been discounted at higher discount factors with the increase in project life, therefore reducing the net PVC. This is evident from table 4.1 where the relative decrease in the PVC of the intermediate technologies is higher than the modern. As the output level (Q) is the same for all the alternative technologies, it has been reflected , therefore in decrease in PVC per unit output.

Finally, the increase in PVC/Unit over the least-cost technology across the modern and the intermediate technologies have been analysed at a discount rate of 15 per cent . The table shows that the least-cost technology (Indian)has a unit cost of Tk.5.40 , while the second-best(Rumanian),Japanese and the UK technologies have PVC/unit of Tk.5.43, Tk.5.57 and Tk.5.79 respectively i.e the unit costs are correspondingly 0.56. 3.15 and 7.22 per cent higher than the least-cost technology. The increase in unit cost of the second-best technology is marginal, while for other technologies it is more pronounced. The unit cost increases further, when the least-cost technology is compared with the intermediate spinning. The PVC/unit cost of the RFC power, ATDA pedal and the KVIC hand-spinning are Tk.6.44, Tk.10.71 and Tk.15.47 respectively. It shows that the respective technologies have about 19.26, 32.59 and 95.74 per cent more unit cost than the least-cost technology. The KVIC hand-spinning has almost twice the unit cost of the least-cost , while unit costs of other intermediate technologies are relatively favourable. It may be summarised that among the intermediate technologies, the RFC power spinning is the most acceptable being able to generate five times the employment of the least-cost technology. While among the modern technology, the second-best emerges as the favourable option to the least-cost ,which provides 3.76 per cent more employment with a marginal increase of 0.56 per cent in unit cost.

PVC, NPV and PVC/Unit at Expected Productivity Level of Alternative Spinning Technologies.

In this section the alternative spinning technologies have evaluated on the basis of the expected or the manufacturer's recommended level of productivity.An obvious advantage of such evaluation is that it would show the improvement which can be achieved on profitability and unit cost with the increase in the productivity level. The expected level of productivity assumes the absence of ineffeciency because of management practice and other operational reasons,i.e the absence of x-effeciency. In other words, it examines the sensitivity of the investment criteria at a higher level of effeciency. It should be noted however, that the productivity level of the ATDA pedal and the KVIC hand-spinning has been considered for the actual level and would therefore remain unchanged. Table 7.4 shows the PVC, NPV and the PVC/unit of the alternative spinning technologies at the expected productivity level. The analysis of the results would put emphasis on the discount rate of 15 per cent, as the characteristics of the findings do not alter significantly at other discount rates to off-set the overall conclusion.

Present Value Cost (PVC)

Table 7.4 indicates that the ranking of the technologies remained unchanged at the expected level of productivity. The Indian spinning technology continued to be the least-cost technology. The PVC of the technologies have decreased with the increase in the productivity level . For the least-cost and the second-best technologies, they are Tk.597.16m and Tk.602.14 million respectively, which are about 1.66 and 1.30 per cent less than the actual productivity level. Which means that the PVC could be reduced by these proportions if the productivity effeciency increases to the expected level. However, it suggests that

TABLE 7.4

PVC,K/L,NPV AND PVC/UNIT OF ALTERNATIVE SPINNING TECHNOLOGIES

AT EXPECTED PRODUCTIVITY

(In Million Taka)

Technologies	Ranking	Total Capital Cost	Annual Operating Cost	PVC at Discount Rates			NPV at Discount Rates			PVC/Unit at Discount Rates(in Taka)		
				10%	15%	20%	10%	15%	20%	10%	15%	20%
Modern												
INDIAN(LC)[1]	I	213.20	111.26	869.19	597.16	437,39	37.24	(16.03)	(40.16)[3]	7.74	5.31	3.89
RUMANIAN(SB)[2]	II	218.78	111.65	875.48	602.14	441.51	31.03	(20.99)	(44.27)	7.79	5.36	3.93
JAPANESE	III	251.27	111.09	895.64	620.63	458.24	11.13	(39.38)	(60.96)	7.97	5.52	4.08
U.K	IV	274.67	112.80	923.51	642.53	476.18	(16.54)	(61.21)	(78.88)	8.22	5.72	4.24
Intermediate												
RFC Power Spg.	V	244.67	138.91	1,042.42	701.85	503.96	(138.01)	(121.45)	(107.00)	9.28	6.25	4.49
ATDA Pedal Spg.	VI	265.53	163.93	1,202.79	803.80	572.84	(298.70)	(223.30)	(175.69)	10.71	7.16	5.10
KVIC Hand Spg.	VII	477.93	222.53	1,737.47	1,187.20	865.68	(826.68)	(604.08)	(467.40)	15.47	10.57	7.71

Note: 1/ LC : Least Cost Spinning Technology
2/ SB : Second Best Spinning Technology
3/ ( ) : Figures in bracket are negatives.

the actual level of productivity attained by the second-best technology is higher in proportion to the least-cost and the relative decrease in PVC at the expected productivity level would be lower for the second-best technology. It has been found that the PVC decreases with higher discount rates; the PVC in excess of minimum between the least-cost and the second-best technologies is Tk.4.98 i.e it increases by Tk.2.14million/from the actual productivity level. Consequently, the cost of per additional job compared to the least-cost technology increases from Tk.74.74 to Tk.130.50 thousand, i.e about 75 per cent. The increase in the cost per additional employment created compared to the least-cost technology have been due to the relatively lower level of improvement in actual productivity of the second-best technology over the least-cost . The PVC of the Japanese and the UK technology at the expected productivity level are Tk.620.63m and Tk.642.53 million respectively i.e their PVC would be reduced by 0.9 and 1.3 per cent at the expected productivity levels. This shows that the decrease in PVC at higher effeciency would be minimum for the Japanese technology, while for the UK, it would be identical to the second-best technology. This is due to the relatively high achievement of the actual productivity level over the expected by the Japanese technology, while for the Indian, it was low (see productivity assumption). The reduction in PVC at alternative discount rates would be lower at higher rates for the Japanese and the UK technologies. However, even if these technologies improve their operating conditions and reduce all x-ineffeciencies yet at the expected level of productivity they remain an ineffecient choice. UK remains to be the highest cost technology with low employment level followed by the Japanese spinning.

The PVC of the RFC power spinning at the expected level of productivity is Tk.701.85 million , while for the ATDA pedal and the KVIC hand-spinning it remained the same. The reduction in the PVC of the RFC spinning is about 3.08 per cent i.e the RFC has the lowest level of actual productivity but considerable improvement in the PVC could be

achieved if the expected level of production could be attained. This is indicative of the scope of improvement in economic effeciency which exists for this technology making it a more attractive option among the alternative intermediate technologies. The reduction in PVC, however, at different discount rates declines with higher discount rates. ~~as for the modern technology~~. The PVC in excess of minimum decreased from Tk.116.26 million to Tk.104.69 million for theactual to the expected level of productivity i.e a decrease of 9.95 per cent. It shows that the cost of the additional jobs compared to the least-cost technology have decreased from Tk.27.16 to Tk.24.46 thousand which shows that the cost per additional job could be saved by Tk.2.7 thousand, if the technology attains the expected productivity level. On the other hand, the RFC power spinning technology would be an attractive option being able to generate employment expansion. Although the PVC of the ATDA pedal and the KVIC hand-spinning are the same at the same at the expected productivity level, but the PVC in excess of minimum would increase if the expected productivity level of the least-cost technology could be achieved. The cost in excess of minimum for the ATDA pedal and the KVIC hand-spinning would increase from Tk.196.58m to Tk.206.64 million and from Tk.579.98m to Tk.590.04 million respectively. Consequently, the cost of additional jobs compared to the least-cost technology increases from Tk.17.46 to Tk.18.35 thousand and Tk.17.04 to Tk.17.34 thousand for the ATDA pedal and the KVIC hand-spinning respectively. Although, these increase are marginal,nevertheless they emphasize that at a high level of productivity, the modern technology, the ATDA pedal and the KVIC hand-spinning would appear as less economically attractive option. Even though the second-best technology loses some effeciency to the least-cost when attempting to attain the expected producitivity level,yet remains the second-best option to the least-cost technology.

Net Present Value (NPV)

The ranking of the technologies by the NPVs did not change at the expected productivity. However, if all the alternative sources of modern and intermediate spinning technologies could attain the productivity level recommended by the manufacturer i.e the expected level, then their economic effeciency would have increased considerably . Table 7.4 for instance shows that,the least-cost technology at 10 per cent discount rate would have a NPV of Tk.37.24 million compared to Tk.21.59 million at the actual productivity level. This is an increase of Tk.15.65 million because of the increase in productive effeciency. While at the same discount rate , the increase in NPV of the Rumanian and the Japanese technologies would be from Tk.18.8m to Tk.31.03 million and Tk.2.35m to Tk.11.13 million, which is an increase of Tk.12.23millinn and Tk.8.78million for the respective technologies. Therefore, the least-cost technology would have the highest increase in NPV followed by the second-best. Earlier findings have shown(See Productivity Assumption) that the Japanese technology had attained the higher level of actual productivity, despite which the NPV differential remains high between it and the least-cost technology. This is because the Indian technology is relatively less capital intensive, i.e about 85 per cent of the Japanese. The UK technology,on the other hand, does not have positive NPV at the expected level of productivity. However, its loss in NPV/has decreasedfrom Tk.29.80m to Tk.16.54 million. Similarly, the loss in NPV of the RFC power spinning reduces from Tk.171.50m to Tk.138.01 million. The net saving i n loss by the UK and the RFC technologies are Tk.13.26million and Tk.33.49 million respectively. Therefore, the RFC power spinning realises the highest level of savings in loss, followed by the UK technology if operated at the expected level of productivity.

. It can be said that increased economic

effeciency can be realised with the achievement of expected level of producitivity. The cost to the economy could be minimised considerably even at the existing level of input-output costs/and if the subsidy required for the technologies/could be reduced. For the ATDA pedal and the KVIC hand-spinning , the NPVs remain unchanged as their productivity at the expected and the actual levels have been found to be identical. Therefore the cost to the economy would not be reduced if any of these technologies are chosen as options , unless their production technology are geared to improve the level of productivity. However, the employment potential of these technologies are very significant.

The NPVs at 10 and 15 per cent discount rates for all the alternative technologies are negative. But at the expected level of productivity, there would be net savings in the loss of NPVs by the alternative sources of modern and the RFC power spinning. At 15 and 20 per cent discount rate, the net savings in NPV loss of the least-cost technology are Tk.10.06 million and Tk.6.89 million respectively. Therefore at higher discount rates the net savings from the loses declines for the least-cost as well as other alternative technologies. This is because the investment outlay of all these technologies takes place in the early years of the project life when the discount factors are low , while the benefits are progressively discounted at a higher discount factors.

It thus appears that even if the alternative technologies attain the expected productivity level i.e the manufactuere recommended level,at NPVs above 10 per cent discount rate, they would all be considered ineffecient. However , at 10 per cent discount rate, the UK remain to be the only technology among the modern spinning with a negative NPV. The UK technology would prove to be the most ineffecient

choice with the highest capital cost and the lowest employment level. In contrast, the least-cost technology only incurs 77.6 per cent investment cost of the UK . The expected level of productivity would not , however, account for the relative disadvantage of higher investment cost of the UK technology. Although, at higher discount rates the NPVs of all the alternative spinning technologies are negative, but at the expected productivity level , the loss in their NPVs are substantially reduced. This indicats that the achievement of higher productivity level enhances the economic effeciency of the alternative technologies. The increase in effeciency could be more rewarding then making choice among the alternative technologies. 2/ The NPV, for example, of the second-best technology at 10 per cent discount rate at the actual level of productivity is Tk.2.79 million less than the least-cost, but, if the level of the second-best technology is improved to its expected level then its NPV would increase by Tk.9.44 million than the least-cost.

Present Value Cost/Unit Output

The PVC/unit reduces at the expected level of productivity for the alternative sources of modern and the RFC power technology. For the ATDA pedal and the KVIC hand-spinning it remains constant as their expected and actual productivity levels are identical. Table 7.4 shows that the PVC/unit of the least-cost technologies at 10, 15 and 20 per cent discount rates are Tk.7.74, Tk.5.31 and Tk.3.89 respectively * Similarly, the unit cost of the second-best have decreased by 1.4, 1.29 and 1.25 per cent respectively. Therefore the decline in the unit cost of the second-best technology would lower than that of the least-cost. The unit cost of the Japanese and the UK technologies at 10, 15 and 20 discount rates would be reduced by 1.0, 0.9 and 0.73 per cent and 1.32 , 1.21 and 1.18 per cent respectively. The reduction in the unit cost of the Japanese technology is the lowest in the modern sector, followed by the UK. Finally, the unit cost of the RFC power spinning at the same discount rates is reduced by 3.13, 2.95 and 2.81 per cent respectively,

* which shows a reduction in unit cost by 1.78,1.67 and 1.52 per cent from the actual level of productivity at the respective discount rates.

2/ The Choice of Technology in the Production of Cotton Cloth, by J.Pickett and R.Robson,Scottish Academic Press,1981(Cont)

while the unit costs of the ATDA pedal and the KVIC hand-spinning remain the same. These findings establish that the highest reduction in PVC could be attained by the RFC power spinning followed by the least-cost, the second-best, UK and the Japanese technologies, if the actual productive effeciencies could be raised to their expected levels. It has also been revealed that the reduction in the unit costs would decline at higher discount rates for all the alternative technologies.

The increase in unit cost over the least-cost technology at the expected level of production have been examined only at the discount rate of 15 per cent. It points out that the differential in unit cost between the least-cost and the second-best technologies have increased from 0.56 to 0.84 per cent , while for the Japanese and the UK technologies these differentials have increased from 3.15 to 3.93 per cent and from 7.22 to 7.72 per cent respectively. Therefore, among alternative sources of modern technologies, the unit cost differential over the least-cost would increase further for all other modern technologies. In other words, at the expected level of productivity, the least-cost technology would be more effecient than the modern alternative technologies. But as the unit cost differential between the second-best and the least-cost technologies are relatively smaller than the others, it remains to be the next option to the least-cost. However, the unit cost differential between the RFC power and the least-cost technology reduces from 19.26 to 17.70 per cent at the expected productivity level. This signifies that at the expected productivity level,the RFC spinning would be more attractive as an option than at the actual level. It is therefore possible that if the technology of the RFC power spinning could be improved upon to realise higher level of productivity, then in terms of employment generation , it could be a better option than any other intermediate technologies. Finally, at different rates of discount,the arguments thus put forward do not alter, however, the magnitude of these differentials change.

2/ (Cont.) p.164. Pickett and Robson argued that improvement in productive efficiency could result in profitibility,which could more or less corresponds with the gain from the Choice of Technology.

Ranking of the Alternative Handloom Weaving Technologies

In this study two types of handloom weaving have been considered viz. the Pit and the C.R looms, which are widely used. Before the looms can be combined with the optimum or the least-cost (Indian) spinning to form a complete alternative process technology, it is necessary to establish the more effecient handloom technology ~~and the two alternatives considered~~ when the yarn is supplied from the modern or the intermediate or processed warp-beam from the Service Centre. The loom which emerges to be the more effecient would then be combined to form the composite alternative technologies.

It has been established earlier that the least-cost spinning technology (Indian) is relatively more effecient than the intermediate (RFC Power) spinning. However, the RFC Power spinning emerges to be the most effecient spinning among the intermediate technologies. Hence the handloom weaving which is found to be more efficient, i.e either the Pit or the C.R loom would be combined with the RFC power spinning or the Service Centre. However the results presented here would be extended to consider both the looms when combined with the intermediate spinning and the Service Centre. It is to be noted that it has already been assumed in Chapter-6 that when supplied yarn from the modern sector, the handloom would be subject to a 10 per cent distribution cost and other expenses above the ex-factory price.
While this distribution cost and other expenses would be 5 per cent for the intermediate and the Service Centre, as these would be located near the handloom concentrated areas. Table 7.5 shows the PVC, NPV and the PVC/unit of grey cloth when the yarn is supplied from either the modern or the intermediate sector. As the handloom productions have been estimated from the survey conducted, the estimated and the actual level of productivity are identical.

Present Value Cost (PVC)

Table 7.5 shows that the Pit loom has the lowest PVC when processed warp beam is supplied from the Service Centre. The PVC of the Pit and the C.R looms when receving warp beam from the Service Centre at 15 per cent cost of capital are Tk.955.0million and Tk.976.05 million, while their employment levels are 17,878 and 14,431 respectively. It appears therefore, that the PVC of the C.R loom rises by about 2.2 per cent compared to the Pit loom, while the employment falls by 3,447. However, if the yarn is supplied by the intermediate spinning , their PVC would be Tk.987.21 million and Tk.1008.35 million respectively i.e an increase in PVCs from the Service Centre by 3.37 and 3.3 per cent respectively, while the employment would also increase by 3,966 for both the looms. Finally, for yarn supplied from the modern spinning , the PVCs for the Pit and the C.R looms are Tk.1,017.25 million and Tk.1,038.39 million respectively. This indicates an increase of 3.04 and 56.52 per cent for Pit and 2.98 and 6.39 per cent for C.R looms when supplied yarn from the intermediate spinning and the Service Centre respectively.For different discount rates , the PVCs of the Pit and the C.R looms declines at higher discount rates irrespective of the sources of input supply.

From the findings established above two conclusions emerge. First of all Pit loom is the most effecient option irrespective of the input sources, while the C.R loom does not only have higher PVC but also inherits lower level of employment. It also has a K/L ratio , about 30.42 and 25.43 per cent higher than the Pit loom depending on whether preparatory weaving is carried out in the Service Centre or by the traditional method. The selection of the Pit loom as an option appears not only as economically effecient but has been found to require less

TABLE 7.5

PVC, K/L, NPV AND PVC/UNIT OF ALTERNATIVE HANDLOOM TECHNOLOGIES

AT ACTUAL PRODUCTIVITY
(In Million Taka)

Technologies	Ranking	Total Capital Cost (K)	Employment (L)	K/L ('000)	Annual Operating Cost	PVC at Discount Rates 10%	15%	20%	NPV at Discount Rates 10%	15%	20%	PVC/Unit at Discount Rates (in Taka) 10%	15%	20%
Warp Beam[1] From S.C														
Pit Loom	I	272.14	17,878	15.22	212.62	1468.30	955.00	661.94	74.37	36.52	16.97	1.981	1.288	0.893
C.R.Loom	II	286.39	14,431	19.85	211.76	1489.07	976.05	681.88	53.84	15.56	(3.11)[2]	2.009	1.317	0.920
Yarn From RFC Spg.														
Pit Loom	III	251.30	21,844	11.50	224.76	1525.97	987.21	680.49	14.37	3.47	(2.07)	2.059	1.332	0.918
C.R.Loom	IV	264.93	18,397	14.40	223.89	1546.90	1008.35	700.48	(6.30)	(17.58)	(22.03)	2.087	1.360	0.945
Yarn From Modern Spg.														
Pit Loom	V	251.30	21,844	11.50	232.08	1572.67	1017.25	701.07	(32.32)	(26.57)	(22.65)	2.122	1.372	0.946
C.R.Loom		264.93	18,397	14.40	231.24	1593.59	1038.39	721.06	(53.00)	(46.62)	(42.61)	2.150	1.401	0.973

Note: 1/ S.C. : Service Centre
2/ ( ) : Figures in bracket are negatives.

investment, that is, low capital cost per job. Secondly, the relative effeciency of the Pit loom increases progressively when the input sources are the modern and the intermediate spinning and the Service Centre. If yarn is the input used in handloom then the intermediate spinning appears to be the economically effecient choice.

It is to be noted that the yarn prices considered for the modern and the intermediate spinning were identical, but because of the proximity of the intermediate spinning units, its distribution costs were 5 per cent lower. Therefore the findings reveal the sensitivity of the PVCs with differential in yarn prices, and do not consider the Intermediate spinning as a relatively effecient choice. However, it emphasises the fact that the yarn price encountered by the handloom weavers is an important factor in the competitive cost of production with the modern sector. It may be added here that the handloom weavers presently face upto 30 per cent higher than ex-factory prices of yarn which contributes to a large extent to the ineffeciency of this sector.

It has been marked that the Pit loom has the least PVC than all the other options when the traditional weaving is replaced by the Service Centre. However, it experiences an increase in investment cost from Tk.250.68m to Tk.272.14 million i.e by 8.56 per cent. As the Service Centre reduces employment by 3.966, the capital-labour ratio consequently increases from Tk.11.48 to Tk.15.22 thousand, which is an increase of 32.58 per cent. Therefore the relatively high effeciency of the Service Centre over the traditional preparatory weaving combination requires a close examination. It reveals that if the preparatory weaving material is processed in the traditional method than the cost of additional jobs created would be Tk.8.21

and Tk.15.70 thousand compared to the least PVC (Service Centre) depending on whether the yarn is supplied from the intermediate of the modern spinning sources respectively. Alternatively this may be expressed as 1 per cent increase in PVC over the least -cost would cause a relative increase of 6.58 per cent in employment if yarn is supplied from the in termediate spinning source and 3.41 per cent from the modern. It is evident, therefore, that although the Service Centre preparatory weaving is the least-cost option, however, the traditional preparatory weaving appears to be an attractive alternative in terms of employment expansion .

Net Present Values (NPVs)

Table 7.5 shows that the ranking of the NPVs of the traditional handloom weaving remain unaltered as the unit revenues for all the alternatives are the same. In this section, the changes in profitability of the Pit and the C.R looms at 10, 15 and 20 per cent discount rates would be discussed when the inputs are supplied from the Service Centre, Intermediate and modern spinnings. However, emphasis would given on the Pit loom to analyse the change in profitability and employment with the changes in input sources. At 10 per cent discount rate the NPVs of the Pit and the C.R looms , when warp beam is supplied from the Service Centre are Tk.74.37 million and Tk.53.84 million respectively. This indicates that both the handloom technologies are effecient and generate surplus , however, the Pit loom has about Tk.20.53 million more net surplus than the C.R. At the same discount rate with yarn supplied from the intermediate spinning source , it is only the Pit loom which has a NPV of Tk.14.37 million , while the C.R loom requires a net subsidy of Tk.6.30 million. If the supply source is modern then both the looms are ineffecient and entail subsidy. At 15 per cent discount rate , the NPVs of

the Pit and the C.R looms with the Service Centre as the input source are Tk.36.52 million and Tk.15.66 million respectively which is a decrease from the NPVs at 10 per cent discount rate by Tk.37. million and Tk.38.28 million respectively. The high proportion of decrease in NPV of C.R.Loom is due to its higher capital costs. However, the differential in NPVs have increased only marginally by Tk.0.43 million. With intermediate spinning as the supply source, the NPV of the Pit loom is Tk.3.47 million, while the C.R loom becomes relatively more ineffecient than at 10 per cent discount rate. At 20 per cent discount , it is only the Pit loom which has a positive NPV of Tk.16.79 million , while the other technologies become highly ineffecient requiring subsidies. It is therefore, only the least-cost handloom weaving technology (Pit loom) which generates net surplus at all the different discount rates. Another aspect which emerges from the table is that when the yarn is supplied from the modern spinning source the (relative) net loss in the NPVs decreases with the increase in the discount rates,although the losses are still higher than those of other options. This could be because the discounted benefit at higher discount rates are relatively higher .Finally, the changes in the NPVs of the Pit loom with the employment have been examined. It showed that the loss in the NPV ,if the yarn is supplied by either the intermediate or the modern spinning sources instead of warp beam from the Service Centre is Tk.33.05m and Tk.63.14 million respectively which is almost identical to the increase in PVCs by the same sources of supply. Therefore similar to the conclusion arrived at during PVC analysis, it may be said here that the percentage of loss in the NPVs over the least-cost technology would be relatively less than the increase in employment. The Pit loom with traditional preparatory weaving when supplied with yarn from the modern and intermediate spinning sources offers an attractive alternative if the expansion of employment is the policy objective.

Present Value Cost/Unit (PVC/Unit)

The least-cost handloom technology (Pit loom) has the PVC/unit of Tk.1.98, Tk.1.29 and Tk.0.89 at Discount rates of 10, 15 and 20 respectively. The unit cost decreases by about 35 and 55 per cent at 15 and 20 per cent discount rates respectively. The decrease in unit costs with the increase in discount rates is common to all the handloom weaving technologies. The PVC/unit increases for both the Pit and the C.R looms progressively with the Service Centre, Intermediate and the modern spinning as the input sources. At 15 per cent discount rate their unit costs are Tk.1.29 and Tk.1.32 respectively, when warp beams are supplied from the Service Centre. The unit cost of the C.R loom is therefore, about 2.25 per cent higher than that of the Pit loom. If the sources of yarn supply are the modern and the intermediate spinning, then the unit cost differential would be 2.10 and 2.11 per cent respectively. ~~Even though the unit cost differential decreases, the C.R loom always has relatively higher unit cost.~~ The least-cost handloom (Pit loom) has unit costs of Tk.1.28, Tk.1.33 and Tk.1.40 when warp beam is supplied from the Service Centre and yarn from the intermediate and the modern spinning. The unit cost, therefore, increases by 3.42and 6.52 per cent if the preparatory weaving is replaced by the traditional method and yarn is supplied from the intermediate and the modern spinning sources respectively.

Ranking of the Alternative Composite(Spinning and Weaving) Technologies

The least-cost spinning and handloom technologies and their relative rankings with other alternatives have been established earlier. This section examines the complete textile process of twelve established alternative technologies which process raw-cotton and yield grey cloth as final output. Ideally, if the least-cost spinning and handloom weaving technologies are considered , then all the spinning technologies would have to be excluded as it is only the Indian spinning which can be combined with the Pit loom weaving. It has also been noted that the relative economic effeciency of the Pit loom increases if traditional preparatory weaving is replaced by the Service Centre. Therefore , the modern, intermediate and traditional technologies would ultimately have to be combined with the Indian spinning, Service Centre and the Pit loom weaving. As for composite weaving under the same factory shed, the other alternatives would be modern technologies with UK, Japan, India and Rumania as machinery sources and RFC composite unit with power and pedal looms. So far only the effeciency ranking of the spinning and the handloom weaving has been examined which does not take into account the modern and the RFC weaving. Therefore, it is the seven alternative composite technologies which are required to be evaluated and rankad in order to establish the least-cost composite technology.

However, the ananlysis here would take into consideration all the twelve alternatives which have been established. When traditional handloom is combined with the modern and the intermediate spinning ,it is only the Pit loom which would be combined with the intermediate spinning , while both the Pit and the C.R looms would/be combined with the least-cost (Indian) spinning of the modern spinning technology. An increase in the number of the alternatives would not really

affect the effeciency ranking, However,as all the intermediate spinning have large employment complement, the inclusion of these alternatives would widen the scope of evaluation of the employment expansion possibilities in relation to their economic effeciency. The difference in employment level between the alternative sources of modern spinning is not significant, therefore the least-cost spinning which has the second highest employment among them , has been combined.The C.R loom which is to be combined with the least-cost Indian spinning has been included as because it is widely in operation in Bangladesh and occupies 23 per cent of the total handloom capacity . Its ranking among the twelve alternatives, has therefore been considered to be important.

When establishing the least-cost spinning technologies, raw-cotton was the input used, while for handloom, it was either processed warp beam or yarn depending on whether the supply source was the Service Centre or traditional preparatory weaving; and the price of the yarn has been taken to be the ex-factory price and the distribution costs. However, when considering the complete textile alternatives, the inputs for all them would be raw-cotton ,therefore the yarn supply to the Service Centre and the handloom weavers would not be at ex-factory price. Therefore the price of yarn to all the modern and the intermediate spinning would be reflected on their respective unit costs, while for handloom weaving, it would be for unit cost of both the modern and the intermediate depending on which technology the traditional weaving is combined with. The transfer of yarn from the spinning to the weaving does not involve any problems for the Composite unit except for the inclusion of tax on the amount of yarn to be transferred . However, difficulty arises for the traditional handloom weaving as the yarn has to be transported from the modern and the intermediate units to the handloom units. This constraint

has been overcome by calculating the entire operating costs of the total technology i.e by taking into account the total input , administrative and other costs and adding to them distribution costs and tax. It has been an obvious advantage that the distortion in yarn prices i.e the fixation to favour would not affect the analysis in any way, and would enable to establish the relative effeciecny of the modern, intermediate and the traditional weaving technologies.

The ranking of the technologies would first be carried out at the estimated actual level of productivity, and then as for spinning for the manufacturer's recommended or expected productivity level. These would indicate the savings which could be generated at the expected productivity level of the technologies , their increase in surplus or reduction in loss and finally the reduction in their unit costs.

Ranking of Alternative Sources of Composite Technologies at the Estimated Actual Productivity Level

These rankings would be based on the Present Value Costs of the alternative technologies. The subsequent rankings on the Net Present Value (NPV) and the Present Value Cost per Unit (PVC/Unit) would extensions of the former. For identical unit revenues of the alternative technologies, the ranking of the NPV is expected to remain the same as for the PVC. The PVC/Unit would also give the same ranking as seen in spinning technologies. The emphasis of the analysis would be on the PVC of the technologies and their employment level which would also have bearings on the capital-labour ratios of the alternatives. However, discussion on the NPVs and the PVC/Unit will substantiate the previous findings and illustrate the profitability variation of the technologies with the chosen unit revenues. The PVC/Unit would indicate the differential in unit cost of the alternative technologies.

PVC and the K/L Ratios of the Alternative Composite Technologies.

Present Value Costs (PVCs)

The rankings of the modern, intermediate and the combined modern, intermediate and the traditional technologies have been given in table 7.6. The PVCs of these technologies have been calculated for capital costs 10, 15 and 20 per cent , and the least-cost technology has been ranked as Roman I followed by successive technologies with higher PVCs. The table shows that the ranking of the least-cost composite technology is identical as for the spinning and the Indian source emerges to be the least-cost technology. Among other alternatives, the combined modern spinning (least-cost), the Service Centre and the Pit loom rank just after the highest PVC of the modern alternatives. The intermediate spinning and power loom appears to be the second best among the combined technology ranking. It has been found that the ranking of the technologies is not so sensitive to the changes in the discount rates, however, the decline in the PVC at higher discount rates is significant.

The PVCs of the least-cost technology at 10, 15 and 20 per cent discount rates are Tk.1194.47 m , Tk.838.94m and Tk.627.30 million respectively. The PVC decreases by 29.76 and 47.48 per cent at higher discount rates of 15 and 20 per cent respectively. All the magnitude of the percentage change of the PVCs may vary, but these characteristics are common for all the technologies, except for technology which ranks as XI. In this case, at 10 per cent discount rate the PVC is lower than that of the previously ranked technology , while at 15 and 20 per cent the ranking has been maintained. As the ranking is invarient at different discount rates, the relative change of PVC between the least-cost and other alternatives would be ascertained for only 15 per cent capital cost.

TABLE 7.6

PRESENT VALUE COST(PVC) OF ALTERNATIVE COMPOSITE TECHNOLOGIES

AT ESTIMATED ACTUAL PRODUCTIVITY

(In Million Taka)

Technologies	Ranking	Total Capital Cost (K)	Employment(L) ('000)	Capital /Labour (K/L) ('000)	PVC at Discount Rates 10%	15%	20%	PVC in Excess of L.C.at 15 per cent	Increase in (L) Over L.C Spinning	Cost/ Additional job Compared to L.C('000 Tk)
Modern										
INDIAN(L.C) 1/	I	394.37	1,697	232.40	1,194.47	838.94	627.30	-	-	-
RUMANIAN(S.B) 2/	II	404.82	1,735	233.32	1,209.73	850.60	636.68	11.66	38	306.84
JAPANESE	III	422.42	1,684	250.84	1,221.73	861.35	646.28	22.41	(13) 3/	
U.K	IV	513.72	1,599	321.28	1,295.06	923.75	700.27	84.81	(98)	
Modern/Intermediate/Traditional										
LCS+SC+ Pit loom 4/	V	485.34	13,656	35.54	1,465.17	990.94	714.96	152.00	11.959	12.71
RFC Power Loom	VI	433.73	12,248	35.41	1,468.81	1,001.88	728.81	162.94	10,551	15.44
LSC and Pit Loom	VII	463.88	17,622	26.32	1,568.07	1,052.22	753.39	213.28	15,925	13.39
LSC and C.R.Loom	VIII	478.13	14,434	33.12	1,589.00	1,073.36	773.38	234.42	12,737	18.40
RFC Spg+Pit Loom	IX	495.66	21,902	22.63	1,713.80	1,139.32	807.97	300.38	20,205	14.87
ATDA Spg+Pit Loom	X	516.21	34,112	15.13	1,840.69	1,219.64	861.97	380.70	32,415	11.75
RFC Pedal Loom	XI	592.77	17,728	33.44	1,766.96	1,221.62	900.62	382.68	16,031	23.87
KVIC Spg+Pit Loom	XII	728.61	56,884	12.80	3,922.56	2,905.33	2.256.97	2,066.39	55,187	37.44

Note: 1/ L.C : Least Cost Composite Technology
2/ S.B : Second Best Composite Technology
3/ ( ) : Figures in bracket are negatives.
4/ LSC+SC: Least Cost Spinning(Indian) and Service Centre.

Among the alternative modern composite technologies, the PVCs of the least-cost (Indian), the second-best (Rumanian), Japanese and the UK are Tk.838.94m, Tk.850.60,m Tk.861.35m and Tk.923.75 million respectively. The PVC differential between the least-cost and the second-best and the Japanese are relatively less significant, i.e 1.39, and 2.67 per cent, while the differential increases by 10.11 per cent when compared with the UK technology. It appears that the difference in the PVCs of the second-best and the UK technology compared to the least-cost have relatively increased for Composite than the spinning i.e from 0.5 to 1.39 per cent, and 7.2 to 10.11 per cent, while for the Japanese, it has decreased from 3.14 to 2.67 per cent. Therefore , irrespective of higher loom capacity i.e 100 and 50 more looms than the UK and the Rumanian technology, the Japanese composite technology has relatively narrowed down its effeciency differential than its spinning unit. However, it is not sufficient to emerge as the least-cost or the second-best technology.

The PVC differentials among the alternatives which combine modern, intermediate and the traditional weaving i.e the combined least-cost spinning, the Service Centre and the Pit loom (rank V) and RFC power loom (rank VI) , follows closely the UK composite technology and have PVCs of Tk.990.96 million and Tk.1,001.88 million respectively. The PVC differential between then are 18.12 and 19.42 per cent respectively. It appears that although the differentials in PVCs between the least-cost and the combined composite technologies is significant , but less noteworthy between the combined composite (rank V) and RFC power loom (rank VII) which is only 1.3 per cent. The PVCs of the least-cost spinning and Pit or C.R loom are Tk.1,052.22 million and Tk.1,073.36 million respectively. As has been found earlier, the Pit loom emerges as the most effecient alternative in the traditional sector, however its PVC differential with the least-cost is 25.42 per cent, while that of the C.R loom is 27.94 per cent. It may therefore be said that the least-cost spinning and

traditional Pit loom weaving do not appear to be as alternative options to the least-cost or to any modern composite unit, if economic effeciency is the criterion of choice. However, its relative effeciency improves by 6 per cent if the ATDA proposed Service Centre facilities are extended to the handloom weavers. The economic effeciency of the Pit loom compared to the C.R loom was found to be marginally higher by 1.97 per cent when yarn is supplied*. It further shows that the Pit loom has lower PVCs if the input sources are the Service Centre, intermediate spinning(RFC) and the least-cost spinning(Indian) at ex-factory yarn prices than if the yarn is supplied at their unit costs. The increase in PVCs at 15 per cent discount rate for the respective technologies are Tk.35.94m, Tk.152.11m and Tk.56.11 million respectively. This highlights two very important aspects, first of all , if the handloom weavers had to procure the input (yarn) at its cost of production instead of the highly subsidised prices which are presently offered to them then the handloom weaving would be further less attractive compared to the least-cost or all the modern composite technologies. Secondly, although the distribution cost of input for the intermediate spinning (RFC) is half of the modern spinning sources, nevertheless , its increase in PVC is much higher when combined with the Pit loom. This shows that the Pit loom would be more effecient if supplied with yarn from the modern spinning sources. When the intermediate spinning viz. the ATDA pedal spinning and the RFC Power spinning are combined with the Pit loom, the difference in PVC increases sharply. The PVCs of the ATDA pedal and the RFC power spinning are Tk.1,139.32 million and Tk.1,219.64 million respectively, i.e the RFC power spinning has about 35.48 per cent higher PVC than the least-cost composite unit, while for the ATDA pedal spinning it has increased to 45.37 per cent. Therefore, among the Intermediate spinning, the RFC Power wouldbe much more effecient than the ATDA Pedal spinning to form a composite technology with Pit loom,,if economic effeciency is the criterion of choice.

* at the ex-factory price(See ranking of handloom)

The RFC pedal loom composite technology has the second highest PVC among all the alternatives of Tk.1.221.62 million, but only marginally higher than the ATDA pedal and the Pit loom . Its PVC differential over the least-cost technology is about 45.61 per cent, which increases only by 0.24 per cent compared to the ATDA pedal spinning and the Pit loom. It is interesting to note that the pedal loom if organised under factory-shed condition does not appear to be an attractive option than the handloom weaving if economic effeciency is considered , however such technologies are organised in India by the Khadi and Village Industries Commission. The technology which has the highest PVC is the combination of the KVIC and the Pit loom weaving. Its cost increases very sharply compared to other alternatives and is about 3.46 and 2.38 times higher than the least-cost and the RFC pedal composite technologies respectively.

Capital-Labour(K/L) Ratio

Table 7.5 shows that the investment cost and the capital-labour ratio of the technologies do not correspond with the PVC rankings. Moreover, the rankings for the K/L ratio and the investment costs are not always the same. The least-cost composite (Indian) technology requires the least investment cost of Tk.394.37 million, while the KVIC hand spinning and the Pit loom requires the highest cost of Tk.728.61 million. Among the modern composite unit, the UK source requires the highest capital cost of Tk.513.72 million, which is about Tk.30.7 and 30.26 per cent higher than the least-cost and the second-best technologies. The capital cost requirements of the UK technology is also higher than all the alternatives which combine least-cost and the RFC spinning with the Service Centre and handlooms i.e technologies ranking between V to IX. However , the ATDA Pedal spinning and the Pit loom (rank X) has investment requirement marginally higher(about 0.5 per cent) than the UK composite technology and is Tk.516.21 million. The RFC

pedal loom (rank XI) has the second highest capital cost of Tk. 592.77 million which is about 1.5 times more than the least-cost , while 15.38 per cent higher than the UK composite technology. It appears, therefore, that the UK composite unit requires the highest investment cost among the modern technologies, while the RFC pedal loom requires the highest cost among the intermediate composite and the KVIC hand-spinning and Pit loom, among all the alternative technologies.

The technology with the lowest capital-labour ratio of Tk.12.80 thousand is the KVIC hand-spinning and Pit loom, which also has the highest requirement of investment fund. Although, the least-cost technology has the lowest K/L ratio of Tk.232.40 thousand among the modern composite units, but, however, it is 18.15 times more capital intensive than the KVIC hand-spinning and Pit loom technology. Among the modern composite units, the UK has the highest capital cost per employment of Tk.321.28 thousand followed by the Japanese with K/L ratio of Tk.250.84 thousand, which are 32.24 and 7.93 per cent higher than the least-cost technology. The K/L ratio of the second-best technology is Tk Tk.232.32 thousand, which is marginally higher by only 0.4 per cent than the least-cost composite technology. It is noteworthy that the K/L ratio of the modern composite technologies have increased over the spinning for the least-cost, second-best and the UK sources by 9.88. 11.56 and 13.70 per cent respectively, while for the Japanese , it has decreased by 1.57 per cent. The K/L ratio of the intermediate (RFC)and combined modern, intermediate and traditional/composite technologies are much lower than the least-cost technology , and their differentials of K/L ratio are relatively close to the labour intensive than the least-cost technology. For instance, the least-cost spinning, the Service Centre and Pit loom (rank V) and the RFC power loom composite unit(rank VI) have K/L ratios of Tk.35.54 and Tk.35.41 thousand respectively,which are about 2.77 times higher than the most labour intensive technology. (rank XII) while only 15.30 per cent of the least-cost technology. . The K/L ratios of the least-cost spinning and Pit or C.R looms are Tk.26.32 and Tk.33.12 thousand respectively.Thus the Pit loom has 20.10 per-

cent less capital cost than the C.R looms,however, their capital costs further declines and becomes only 11.32 and 14.25 per cent of the least-cost composite technology. The K/L ratio of the RFC pedal loom composite unit (rank XI) is almost equal to that of the least-cost spinning and C.R loom (rankVIII) and again only 14.38 per cent of the least-cost composite technology. Finally,the ATDA Pedal spinning and Pit loom(rank X) has the second least K/L ratio of Tk.15.13 thousand, which is about 18.20 per cent higher than the least K/L ratio and 6.5 per cent of the least-cost composite unit. It therefore appears that, the lowest K/L ratio is occupied by the least-cost technology among the modern and by the KVIC spinning and Pit loom (rank XII) among the combined modern, intermediate and traditional alternative composite technologies.

Employment Level and Expansion

The employment generated by the alternative modern composite technologies are comparatively lower than the intermediate and other combined modern, intermediate and handloom composite technologies. Table 7.6 shows the least-cost (rank I)composite technology creates an employment of 1,697, while the KVIC hand-spinning and Pit loom (rank XII) generates an employment of 56,884. This indicates that the least-cost creates only 2.98 per cent employment of the most labour intensive technology. Among the modern composite units the differential in employment is less significant than among other alternatives. The second-best (rank II) technology provides the highest employment of 1,735, while the UK technology creates the lowest employment of 1,599.
Therefore, the least-cost technology has about 2.2 per cent less employment than the second-best , while creating about 0.78 and 6.12 per cent more than the Japanese and the UK.
For technologies which rank between V to IX, the employment level rise sharply, however, their rise fluctuates and do not correspond with the effeciency ranking. The lowest employment among these alternatives is provided by the RFC power loom technology (rank VI) which increases progressively for technology ranks V (least-cost spinning + S.C + Pit loom) and VII(least-cost spinning + C.R loom). The employment level of these technologies are 12.248, 13,656 and 14.434 respectively i.e about 7.22, 8.05 and 8.50 times higher than the least-cost. The RFC power loom composite unit (rank VI) which included the RFC Power spinning is organised under the factory-shed condition similar to the modern composite unit. In composite production, the differential in employment level between the RFC and the least-cost technologies have increased from 5.25 times of the spinning production to 7.22, however, unlike the RFC spinning, the RFC composite unit did not rank just after the modern technologies. Its rank in spinning has been replaced by the least-cost spinning, Service Centre and Pit loom (rank V) technology. The least-cost technology and Pit loom(rank VII) and the

RFC pedal loom (rank IX) creates the next successive higher level of employment of 17,622 and 17,728 respectively, which are about 10.38 and 10.45 times more than the least-cost technology. If the Pit loom is combined with the RFC power spinning (rank IX) rather than the least-cost spinning(Indian), the employment would increase from 17,622 to 21,902. This would be an increase of 24.29 per cent , while compared to the least-cost composite technology, its employment level is 12.9 times higher. Finally, the ATDA pedal spinning and Pit loom (rank X) provides the second highest employment of 34,112, which is about 20.10 times more than the least-cost technology. It therefore emerges that the employment expansion possibilites over the least-cost technology is potentially present in all the alternatives, except the Japanese and the UK. However, the economic cost of such expansion is evident in all the technologies and the ensuing discussion would examine such costs.

The expansion of employment is an important policy objective of the Government. However, it appears from table 7.5 that from the point of view of economic effeciency, the least-cost (Indian) composite technology should be the most appropriate choice. The only technically effecient technologies in terms of the total investment cost and the employment level are the least-cost, Japanese and the UK,while the others have high investment costs but with high employment level. Therefore a convex shaped isoquant can be drawn with only these three technologies in the modern sector, while all the others are technically ineffecient. Therefore employment expansion can only be achieved at the expense of economic costs. The magnitude of this cost would depend on the additional PVC which would be incurred for the increased employment . Therefore, it is an issue of trade-off between the economic effeciency and the extra employment which needs to be created, The economic planner of the country would decide on such trade-off depending on the importance attached to the policy of the employment expansion objective.

Similar attempt has been made to examine the trade-off between economic effeciency and employment expansion possibilities of the alternative sources of technologies. This has been done by calculating the increase in the PVCs in excess of minimum and the employment over the least-cost technology. which has been shown in table 7.5. The table indicates that if the expansion of employment at an economic cost is the objective than similar to spinning technologies,the Japanese and the UK options would be rendered as ineffecient, as their rise in PVCs do not correspond with the increase in employment; in fact their employment level decreases. Therefore, the possibility of trade-off would have to be examined between I and II and V and XII technology ranks. The PVC in excess of minimum has been calculated at the discount rate of 15 per cent as the ranking which has been established for the cost of each additional job created compared to the least-cost technology would remain unchanged at higher discount rates. However, it is to be noted that at 10 per cent discount rate the PVC in excess of mnnimum of the RFC composite unit with pedal loom (rank XI) declines from that of the preceeding technology,but at discount rates of 15 and 20 per cent, the established ranking is maintained. Although, the ranking for the cost per additional job created would not change compared to the least cost technology, however, the magnitude of the cost may vary at different discount rates. At discount rates of 10, 15 and 20 per cent for instance, the cost per additional job are Tk.401.60, Tk.306.40 and Tk.246.84 thousand respectively.

In terms of employment expansion , the ATDA pedal spinning and Pit loom composite technology(Rank XI) provides the most attractive option as it requires the lowest cost of Tk.11.75 thousand ,while the second-best has the highest of Tk.306.84 thousand to create an additional job compared to the least-cost technology. It is essential to note that the lowest cost for the creation of each additional job incurred by the composite technologies is significantly lower than the spinning . The KVIC spinning had the lowest cost of Tk.17.04 thousand , which is only 69 per cent of the composite technology(rank XI)

However, if the KVIC hand-spinning is combined with the Pit loom to form a composite unit , the cost per additional job increases to Tk.37.44 thousand i.e by 2.20 times than the KVIC spinning and about 2.95 times than the ATDA(Pedal spinning + Pit loom) composite technology. Similarly, the RFC composite unit with Pedal loom (rank XI) and the least-cost spinning and C.R loom (rank VII) require about 2 and 1.5 times more cost per additional job created than the lowest cost composite technology.(rank XI). The costs per additional job for technologies V, VII, IX and VI are closely associated with the ATDA Pedal spinning and Pit loom (lowest cost) compared to the least-cost, they are Tk.12.71, Tk.13.39, Tk.14.87 and Tk.15.44 thousand respectively. Among these technologies, the least-cost spinning , the Service Centre and Pit loom (rank V) and the least-cost spinning and Pit loom (rank VII) could be examined further for employment expansion. Their costs per additional job are 8.17 and 13.96 per cent higher than the technology which requires the least-cost for the generation of additional employment. Moreover, technology rank V not only has the second lowest cost per additional job, but also the least PVC among all the combined technologies. Technology VII also ranks favourably in effeciency ranking and at present, is widely in practice in Bangladesh. The policy of the Government has been to promote this combined technology to sustain employment i n the handloom sector. It is worth noting that the effeciency ranking of this technology could be greatly increased if the traditional preparatory weaving is replaced by the Service Centre. On the other hand, the RFC composite unit with Power loom (rank VI) and the combined RFC power spinning and Pit loom (rank IX) are not presently in operation in the country. However among these options, technology IX requires marginally lower cost per additional job, but from the point of view of economic effeciency technology VI appears to be a better option for examining possibilities of further employment expansion.

Although, the ATDA pedal spinning and Pit loom (rank X) has the lowest cost per additional job than the least-cost technology and appears to be an attractive option, however, its PVC in excess of minimum of TK.380.70 million represents 45.37 per cent of the least-cost. Moreover, it has the third highest investment cost,which is 1.31 times higher than the least-cost technology. Therefore the technology which has the lowest cost per additional job with the second highest employment expansion of 32,145 compared to the least-cost does not appear to be an option from economic effeciency and capital cost considerations. The trade-off between effeciency and employment expansion is not worth considering for most labour-intensive technologies viz. KVIC hand-spinning and Pit loom (rank XII) as its PVC in excess of minimum is Tk.2,905.33 million, which represents 3.46 times of PVC and 7.37 more than the investment cost of the least-cost composite technology. Thus the relative ineffeciency of this technology has further deteriorated than the KVIC , as an spinning alternative. Similarly, the RFC composite unit with Pedal loom (rank IX) can be rejected as an option because it incurs the second highest cost for each additional job created compared to the least-cost technology. Moreover, its PVC in excess of minimum of Tk.382.68 is almost identical to that of the ATDA pedal spinning and Pit loom (rank X) composite technology, i.e about 45.61 per cent of the least-cost. Its investment cost is also higher than that of the ATDA pedal spinning and Pit loom composite technology. and is 1.5 times more than the least-cost technology. The RFC composite unit with pedal loom does not appear to be worth considering as an option in terms of employment expansion.

The choice is therefore left between the technologies which rank between V and IX. These are all combined composite technologies between the modern, intermediate and traditional or modern and traditional or even intermediate and traditional,

except for the RFC composite unit with power loom which is organised under factory shed production. The investment cost of these technologies falls below the cost of the modern composite unit from UK source. The employment elasticity of the PVCs calculated for these technologies shows that the least-cost spinning and C.R loom (rank VII) has the lowest employment elasticity of 22.91 among them . An increase of 1 per cent in the PVC, therefore generates an employment expansion of about 26.91 per cent which appears to be very significant and also a favourable trade-off. The trade-off effeciency could be further improved if technologies viz. intermediate(RFC) composite unit with Power loom (rank VI) and intermediate(RFC) Power spinning and Pit loom (rank IX) are considered . These technologies have employment elasticities of 32.06 and 33.26 respectively, i.e the employment expansion possibility of technology IX is about 3.74 times higher than the technology VI. However, among the three technologies (i.e VIII,IX and VI),the RFC composite unit with Power loom (rank VI)has the lowest investment cost, which is only 9.98 per cent higher than the least-cost , while technologies VIII and IX require about 21.24 and 25.68 per cent higher investment cost than the least-cost. Moreover,it is placed much higher in effeciency ranking than the other two technologies. Therefore, the RFC composite unit with Power loom would be the best option among the three technologies. Finally,the technology/ ranks V and VII have employment elasticities of 38.94 and 36.93 respectively. Therefore among the combined composite units, the least-cost spinning(Indian) , the Service Centre and Pit loom is the most attractive option with employment expansion possibility of 11,959 which is 7.05 times higher than the employment of the least-cost technology. However, compared to the other options,the least-cost spinning and Pit loom (rank VII) which provides the possibility of an employment of 15,925 thousand i.e about 33.16 per cent higher than /the most attractive option would be next best option. It is worth mentioning here that when the handloom weavers are faced with yarn at ex-factory price instead of at its cost price,the employment

elasticity of PVC for intermediate spinning supplying yarn to the handloom weavers appear to be relatively higher than that of the Service Centre. It is important to note that the comparative advantage of the intermediate spinning diminishes if the distribution costs of yarn for modern and intermediate spinning are identical.

On the other hand, the second-best i.e the Rumanian composite technology could be examined for its acceptability. It has characteristics similar to the Rumanian spinning i.e its PVC in excess of minimum of Tk.11.66 is the lowest among all other alternatives. The PVC in excess of minimum is only about 1.39 per cent of the least-cost option and about 2.95 per cent of the initial investment cost. The additional employment offered by the second-best technology is only 38,which is the same as for the spinning. This appears to be an even marginal contribution to the employment expansion than the spinning. The employment elasticity of PVC is 1.62, which indicative of only 1 per cent increase in PVC and 1.6 per cent for employment. This is not a favourable trade-off; therefore, the second-best option does not appear to be an attractive alternative of the least-cost technology in terms of employment expansion.

Net Present Values (NPVs)of Alternative Composite Technologies

The Net Present Values or profitability of the alternative technologies have been calculated assuming that all of them have identical unit revenues. The selling price of grey cloth output had been estimated from the BTMC and the total revenue of all the alternatives have been given in table 6.41. Table 7.7 shows the ranking of the alternative technologies at three different discount rates of 10, 15 and 20 per cent. The ranking did not differ from the PVC ranking,however at 10 per-cent discount rate the RFC composite unit wit Pedal loom(rank XI) had relatively less loss in NPV than the preceeding tech-nology, but at 15 and 20 per cent discount rates the ranking is maintained.

It appears from the table that profitability of the technologies have increased signifiaantly as a composite unit than the spinning. At 10 per cent discount rate, for example, the UK spinning had negative NPVs, whereas at 15 per cent discount rate the UK composite technologies have positive surplus. At 10 per cent cost of capital,all modern composite units (ranks I to IV) , the least-cost spinning, the Service Centre and Pit loom and RFC composite unit with power loom have negative NPVs ; while technologies between ranks VII to XII have negative NPVs. The positive surplus across the technologies decreases progressively from the least-cost technology of Tk.314.75 million to Tk.87.15 million for the RFC composite unit with power loom. At 15 per cent discount rate, the RFC composite unit becomes ineffecient, while all modern composite units and combined composite units with least-cost spinning, Service Centre and Pit loom remaind to be the only surplus generating technologies. The profitability reduces further at 20 per cent discount rate, when only the least-cost , second-best and the Japanese technologies remain profitable with NPVs of Tk.56.53 million, Tk.47.23m and Tk.37.40 m respectively. The NPVs at 15 per cent capital cost has been chosen

TABLE 7.7

NET PRESENT VALUE(NPV) OF ALTERNATIVE COMPOSITE TECHNOLOGIES

AT ESTIMATED ACTUAL PRODUCTIVITY

(In Million Taka)

Technologies	Ranking	Total Capital Cost (K)	Employment(L) ('000)	Capital /Labour (K/L) ('000)	NPV at Discount Rates 10%	15%	20%	NPV in Excess of L.C.at 15 per cent	Increase in (L) Over L.C Spinning	Cost/ Additional job Compared to L.C('000 Tk)
Modern										
INDIAN(L.C) 1/	I	394.37	1,697	232.40	364.75	161.21	56.53	-	-	
RUMANIAN(S.B) 2/	II	404.82	1,735	233.32	349.90	149.69	47.23	11.52	38	303.16
JAPANESE	III	422.42	1,684	250.84	337.76	138.90	37.60	22.31	(13) 3/	
U.K	IV	513.72	1,599	321.28	265.13	76.74	(16.29)	84.47	(98)	
Modern/Intermediate/Traditional										
LCS+SC+Pit Loom 4/	V	485.34	13,656	35.54	94.50	9.45	(30.95)	151.76	11,959	12.69
RFC Power Loom	VI	433.73	12,248	35.41	87.15	(2.89)	(45.39)	164.10	10,551	15.55
LSC and Pit Loom	VII	463.88	17,622	26.32	(11.04)	(52.86)	(69.83)	214.07	15,925	13.44
LSC and C.R.Loom	VIII	478.13	14,434	33.12	(31.40)	(73.71)	(89.65)	234.92	12,737	18.44
RFC Spg+Pit Loom	IX	495.66	21,902	22.63	(158.75)	(140.66)	(124.67)	301.87	20,205	14.94
ATDA Spg+Pit Loom	X	516.21	34,112	15.13	(285.70)	(220.71)	(178.37)	381.92	32,415	11.78
RFC Pedal Loom	XI	592.77	17,728	33.44	(207.82)	(221.49)	(216.81)	382.70	16,031	23.87
KVIC Spg+Pit Loom	XII	728.61	56,884	12.80	(2360.87)	(1930.78)	(1572.24)	2091.99	55,187	37.91

Note: 1/ L.C : Least Cost Composite Technology
2/ S.B : Second Best Composite Technology
3/ ( ) : Figures in bracket are negatives.
4/ LSC+SC: Least Cost Spinning (Indian) and Service Centre.

for a comparative study across the technologies as this capital cost is used in Bangladesh for Public Sector project appraisal . The NPVs of the least-cost and second-best technologies are Tk.161.76million and Tk.149.69 million respectively,i.e their NPV differential is Tk.11.52 million. The NPVs of the Japanese and the UK composite technologies are Tk.138.90 million and Tk.76.76 million respectively. Therefore the leaat-cost technology has Tk.22.31 million and Tk.84.47 million as excess surplus than the Japanese and the UK composite technologies . This indicates that the relative surplus of the Japanese compared to the least-cost is much higher than the UK. It is to be noted that at 15 per cent discount rate, all spinning technologies have been found to be ineffecient generating negative NPVs. At this discount rate, the only combined compositebbetween the modern,intermediate and traditional technology which generates surplus is the least-cost spinning,Service Centre and Pit loom(rank V).It has a NPV of Tk.9.45 million,however compared to least-cost composite unit,it is substantially low by Tk.151.76m. The RFC composite unit with Powar loom has been found to be ineffecient at this discount rate and the profitability of Tk.87.15 million at 10 per cent discount rate reduced to negative NPV of Tk.2.89 million. The loss in NPVs worsen for the successive technology ranks and the option which provided the second most attractive choice for employment expansion viz. the least-cost spinning and Pit loom (rank VII) has a negative NPV of Tk.52.84 million . It shows that,although the RFC power loom (rank VI)option would have loss in surplus,however,the least-cost spinning and Pit loom(rank VIII)would require net subsidy from other sectors of the economy to create employment expansion of 10,551 and 15,592 respectively. It is obvious that the least-cost spinning and C.R loom would require relatively more subsidy, while its employment expansion would be less than the previous two alternative technologies. Similarly with the RFC composite unit with Pedal loom , when the required subsidy would be higher than the two preceeding technologies , its employment expansion would be less.

Finally, the composite technologies with RFC, ATDA pedal and KVIC hand-spinning when combined with the Pit loom (i.e Technology ranks X, XI and XII) all generates higher loss in NPV of Tk.220.71m , Tk.221.82m and Tk.1,930.78 million respectively. Although, these technologies provided progressively higher employment expansion possibility, however, the subsidy is also required to be increased for subsequent technologies.

It has been noted that the NPVs decrease with the increase in cost of capital. The NPV of the least-cost technology,for example, at capital cost of 10, 15 and 20 per cent are Tk.364.75m, Tk.161.21m and Tk.56.53 million respectively. The loss in surplus from 10 to 15 per cent capital cost is Tk.203.54 million and from 15 to 20 per cent, it is Tk.104.68 million, i.e the proportion of loss was relatively less at higher discount rates. This characteristic of loss in NPVs at higher discount rates is common for all the technologies ranking between I to VIII. However, for those between IX to XII, the net loss have decreased at higher costs of capital . The loss in NPVs, for example,of the combined composite unit of RFC power spinning and Pit loom(rankVIII)at 10,15 and 20 per cent discount rates are Tk.(158.75)m, Tk.(140.66)m and Tk.(124.67) million respectively. This, however appears to be an exception to the previous technology ranks, with the loss in NPV decreasing by Tk.18.09 million when the capital cost increases from 10 to 15 per cent and Tk.15.99 , when it increases from 15 to 20 per cent. This is because , similar to the spinning, the net cash flow of these technologies have reduced substantially due to higher operating costs than the previous technologies. Therefore, at higher discount rates , the cash flows are less negative and thus the sum of their costs and benefits i.e NPVs would be less at higher rates. It is to be noted that the loss in NPV of the RFC composite unit with Pedal loom at 10 per cent capital cost is Tk.207.82million,which represents 73 per cent loss in NPV than the previous technologies,

therefore the ranking of the NPV at 10 per cent capital cost would be elevated for the RFC composite unit with pedal loom technology. However , at 15 and 20 per cent capital costs, the ranking as has been established remains constant.

Finally, table 7.7 shows the loss in NPV per additional job created compared to the least-cost. The results obtained are identical to the costs for additional jobs calculated for the loss in PVC. Therefore, the trade-off between economic effeciency and expansion of employment applicable for PVC would be valid here as well. However, the loss in NPV per additional job created illustrates certain essential characteristics of the alternative technologies. It indicates that if the capital cost is assumed to be 15 per cent then the combined least-cost spinning, Service Centre and Pit loom(rank V) would be the only attractive which would not require any subsidy, however, the loss in NPV would be Tk.151.76 million * The expansion in employment would be 11,959, which shows at 1 per cent decrease in NPV, the increase in jobs would be about 7.50 per cent. The second-best alternative would be the RFC composite unit with power loom which requires marginal subsidy as its loss in NPV is small i.e Tk.(2.89)million. 1 per cent decrease in its NPV would bring 6.10 per cent increase in jobs. The other alternative among combined composite technologies would require successively higher subsidies,and out of them the KVIC spinning and Pit loom(rank XII) would entail the highest subsidy of Tk.1,930.78 million. On the other hand, the alternatives among the modern composite units do not provide any possibility of employment ,as the differential between the technologies are not significant. It is only the second-best technology which provides a marginal increase of jobs and it shows that if there is decrease in NPV by 1 per cent the expansion of employment would be only 0.31 per cent.

* compared to to the least-cost technology.

It therefore, emerges that the present textile policy of a new expansion of auto or power loom in the cotton textile sector, while extending the spinning capacity to supply handloom weavers is a burden to the economy irrespective of the sources of spinning technologies. It appears that even with the most effecient alternative spinning technology, such a policy would cause a loss in NPV of Tk.13.44 thousand for each additional job compared to the least-cost technology out of which Tk.3.32 thousand would have to be subsidised from other sectors of the economy. Economic surplus is an essential element of economic growth, therefore , the present textile policy which subsidises yarn is not only a great cost to the BTMC but also to other sectors of the economy. It has been found, however, that the burden of the present policy could be somewhat alleviated if the traditional preparatory weaving could be replaced by the Service Centre. This would atleast eliminate the requirement of Tk.5.2.86 million as subsidy per additional job which at present is met from the economy. It may be further added here that the replacement of the traditional preparatory weaving with the Service Centre would also yield improved quality output. However, the replacement would require Pit loom of particular specification and construction type capable of carrying the warp-beam. It has been found that there are different types of Pit looms across the country and some of which are not suitable for the use of processed warp-beam with long warp-length. Nevertheless, a warp-beam of 350 yards in length weighing 27 lbs.can be used by most Pit looms. 3/

3/ Types of Pit Loom across the country varies considerably, which are reflected in their price. A Pit loom could cost as little as Tk.400. The Pit loom considered in this study is Tk900 per loom.This loom would be able to carry a Service Centre processed beam with 27lb of yarn. Processed warp beam is already in use in the KVIC type unit viz. The Charka and Cottage Industries organisation,Comilla,Bangladesh,which has been surveyed for this study.However,the preparatory weaving machinery are operated manually.

Present Value Cost Per Unit(PVC/Unit) of Alternative Composite Technologies.

The PVC/unit cost of grey cloth output has been calculated for all modern and combined composite between the modern, intermediate and traditional technologies at the discount rates of 10, 15 and 20 per cent. Table 7.8 gives the unit cost of all the alternative composite technologies alongwith the increase in unit cost over the least-cost technology.

The least-cost technology corresponds with the least-unit costs and have PVC/unit of Tk.1.61, Tk.1.13 and Tk.0.84 at discount rates of 10, 15 and 20 per cent respectively. The unit cost decreases(at higher discount rates , for the least-cost technology it decreases) by 29.81 and 47.83 per cent at discount rates of 15 and 20 per cent respectively. The decrease in PVC/unit is because the investment and operating costs have been discounted at higher rates, while the output remained constant across the technologies. This feature is common for all the technologies, but the magnitude of the decline in costs is variant. The increase in unit cost at different discount rates over the least-cost technologies indicate that for modern composite technologies, the differentials have increased at higher discount rates. The differential in unit cost, for example, between the least-cost and the UK composite technology at 10 per cent discount rate is 8.07 per cent, however, at 15 and 20 per cent ,the differential have increased to 9.73 and 11.90 per cent respectively. On the other hand,the differential between the least-cost and the combined composite technologies have successively reduced at higher discount rates, with the exception of the combined composite unit, viz. KVIC hand-spinning and Pit loom(Rank XII). The unit cost of the ATDA pedal spinning and Pit loom(rank XI), for example reduced from 54.04 to 45.13 per cent and 45.13 to 38.10 per cent when the discount rates have been increased from 10 to 15 per cent and 15 to 20 per cent

TABLE 7.8

PRESENT VALUE COST PER UNIT(PVC/UNIT) OF ALTERNATIVE COMPOSITE TECHNOLOGIES AT ESTIMATED ACTUAL PRODUCTIVITY

(In Million Taka)

Technologies	Ranking	Total Capital Cost(K)	Annual Operating Costs	PVC/Unit at Discount Rates (In Taka) 10%	15%	20%	Increase of PVC/Unit Over the Least Cost(in Per Cent) 10%	15%	20%
Modern									
INDIAN(L.C)[1]	I	394.37	140.98	1.611	1.132	0.846	-	-	-
RUMANIAN(S.B)[2]	II	404.82	142.14	1.632	1.148	0.859	1.30	1.41	1.54
JAPANESE	III	422.42	142.01	1.648	1.162	0.872	2.30	2.65	3.07
U.K	IV	513.72	143.27	1.747	1.246	0.945	8.44	10.07	11.70
Modern/Intermediate/Traditional									
LCS+SC+Pit Loom[3]	V	485.34	187.08	1.977	1.337	0.965	22.72	18.11	14.07
RFC Power Loom	VI	433.73	186.25	1.981	1.351	0.983	22.97	19.35	16.19
LSC and Pit Loom	VII	463.88	206.34	2.115	1.420	1.017	31.28	25.44	20.21
LSC and C.R.Loom	VIII	478.13	205.47	2.144	1.448	1.040	33.08	27.92	22.93
RFC Spg+Pit Loom	IX	495.66	229.59	2.312	1.537	1.090	43.51	35.78	28.84
ATDA Spg+Pit Loom	X	516.21	249.43	2.484	1.646	1.163	54.19	45.41	37.47
RFC Pedal Loom	XI	592.77	214.62	2.384	1.648	1.215	47.98	45.58	43.62
KVIC Spg+Pit Loom	XII	728.61	308.03	5.293	3.920	3.045	328.55	346.29	359.93

Note: 1/ L.C : Least Cost Composite Technology
2/ S.B : Second Best Composite Technology
3/ LSC+SC : Least Cost Spinning and Service Centre.

respectively. But for the KVIC hand-spinning and Pit loom, the cost increased to 328.57, 346.90 and 361.90 per cent at 10, 15 and 20 per cent discount rates. This could be because similar to the spinning i.e the cost flows of the combined composite technologies i.e ranks V to IX are relatively higher than the modern composite technologies. Therefore,at higher capital costs their discounted values are relatively lower than the modern technologies,while the output level for all the technologies remain the same. As a result , the increase in unit cost of the combined composite technologies is relatively low. However, the KVIC hand-spinning and Pit loom poses an exception to this because of higher initial investment of the KVIC hand-spinning which is dis- counted at a comparatively lower discount factors . This has ultimately given reduction in PVC proportionately less than the least-cost technology at higher discount rates. It,however, may be noted here that at 10 per cent discount rate, the PVC/unit of the RFC composite technology with Pedal loom has decreased,while at 15 and 20 per cent, they have increased relatively more than the preceeding technology. This is because, at 10 per cent discount rate, this technology had a PVC which was lower than the preceeding technology.

Finally, it would be well worth to examine the PVC/Unit of the alternative technologies. The comparative increase in unit cost over the least-cost technology has only been accounted for the discount rate of 15 per cent, as the overall characteristics of the increase are identical. Among the modern composite technologies, the increase in unit cost for the second-best and the Japanese technologies were moderate of 1.77 and 2.65 per cent over the least-cost technology. However, the increase in the cost for the UK composite unit of 9.73 per cent was much higher due to its higher investment and operating costs. The increase in the unit costs of the combined composite technologies of ranks V and XI although higher than the modern modern composite technologies, however remained within 50 per-cent in excess of the least-cost technology. But for the KVIC

hand-spinning and Pit loom (rank XII),the unit cost has increased by 3.285 times. Among the combined alterntives, the technologies which have been considered as options for employment expansion, consequently have lower increase in PVC/Unit. For example, the the least-ccst spinning ,Service Centre and Pit loom (rank V) technology, the most favoured combined composite option has the lowest increase of 18.58 per cent among its group. While the unit cost of the RFC composite unit with Power loom (rank VI) is 19.46 per cent , that is marginally higher by 0.88 per cent. than the least-cost spinning the Service Centre(rank V) option. The unit costs of other possible options viz. the least-cost spinning and Pit loom i.e the option which the present textile policy continues to promote, has increased substantially by 25.66 per cent compared to the least-cost technology. Compared to the most attractive option among the combined composite technologies,i.e technology V, its unit cost has increased by 7.08 per cent. The increase in unit costs of other technologies worsen further, however, the technology which had the lowest cost per additional job compared to the least-cost technology viz. the ATDA Pedal spinning and Pit loom (rank X) has an increase in unit cost of 45.13 per cent in relation to the least-cost. It occupies the third highest increase in unit costs among the alternative technologies.

PVC,NPV, PVC/Unit At Expected Productivity Level of the Alternative Composite Technologies

Attempt has been made here to evaluate the alternative composite technologies at the expected or manufacturer's recommended productivity level in a manner similar to the alternative spinning technologies. Such evaluation would indicate the improvement that can be achieved on the effeciencies viz. by reducing the unit cost or increasing the profitability ,if productivity could be raised to its expected level. The improvement on productivity could only be attained by the modern and the intermediate composite units, while the productivity of the traditional technologies have been estimated from actual observation. It is worth noting here that the actual productivity level across the modern weaving have been assumed to be identical because of the absence of other sources of weaving machinery in Bangladesh(See Productivity Assumption). Therefore the increase in expected producitivity level for weaving would be proportionately same for all the technologies. While for the spinning section of the composite unit, the increase in productivity and effeciency would correspond with the analysis for spinning. Therefore the magnitude of the increase in effeciency at the expected level of productivity would not be different to off-set the ranking of the technologies. Nevertheless, measure the absolute decrease in the PVC cost or the increase in profitability at the expected productivity level,the following analysis is believed to suffice. Table 7.9 shows the PVC,NPV and the PVC/Unit of the alternative composite technologies at the expected producitivty level at 10,15 and 20 per cent rates of discount. The emphasis would , however, be on the capital cost of 15 per cent when comparing the alternative technologies.

Present Value Cost (PVC)

At the expected productivity level, the PVC ranking of the alternative composite technologies remain identical to the previous, except for ranks X and XI . In the earlier ranking, the RFC/composite Pedal loom unit(rank X)although had lower PVC than the ATDA pedal spinning and Pit loom(rank XI) at 10 per cent discount rate but at 15 and 20 per cent , it had higher PVC. Therefore, the previous ranking of the RFC Pedal loom composite unit was higher than the ATDA and Pit loom technology. However,at the expected productivity level, because of higher spinning productivity of the RFC Pedal loom, it is found to be relatively more effecient. And at 10 and 15 per cent discount rate , its PVC decreases, although at 20 per cent , its PVC is still higher than the ATDA Pedal spinning and Pit loom technology.

The absolute PVCs of the alternative technolgies have decreased at the expected level of productivity and with higher discount rates. The comparative decrease in the PVC have beenanalysed at the single discount rate of 15 per cent. It indicates that the Indian composite unit remain as the least-cost technology among the alternatives. The PVCs of the least-cost and the second-best technologies are Tk.822.78m and Tk.835.95 million. At the expected productivity,the PVCs of these technologies havedecreased by 1.92 and 1.72 per cent respectively. Similarly, the PVCs of the Japanese and the UK technologies are Tk.848.28m and Tk.909.89 million i.e the PVCs have reduced by 1.52 and 1.50 per cent respectively. Therefore, the highest reduction in PVCs could made for the least-cost technology, if the expected productivity level could be attained which would further enhance the effeciency of this technology. It also, however, suggests that the actual productivity achieved among the modern composite units was the lowest for the least-cost spinning. But, despite its low productivity level , the least-cost technology,because of its low investment cost of 76.77 per cent compared to the UK,

TABLE 7.9

PVC, NPV AND PVC/UNIT OF ALTERNATIVE COMPOSITE TECHNOLOGIES

AT EXPECTED PRODUCTIVITY
(In Million Taka)

Technologies	Ranking	Total Capital Cost (K)	Annual Operating Cost	PVC at Discount Rates			NPV at Discount Rates			PVC/Unit at Discount Rates (in Taka)		
				10%	15%	20%	10%	15%	20%	10%	15%	20%
Modern												
INDIAN(LC)[1]	I	394.37	140.98	1169.08	822.78	616.37	390.12	177.36	67.47	1.577	1.110	0.832
RUMANIAN(SB)[2]	II	404.82	138.38	1186.68	835.95	626.76	372.95	164.35	57.15	1.601	1.128	0.846
JAPANESE	III	422.42	138.65	1201.19	848.28	637.44	358.30	151.96	46.45	1.621	1.145	0.860
UK	IV	513.72	139.67	1273.32	909.89	690.90	286.97	90.60	[3](6.92)	1.718	1.228	0.932
Modern/Intermediate/Traditional												
LCS+SC+Pit Loom[4]	V	433.73	184.67	1449.94	981.17	708.28	109.72	19.22	(24.28)	1.956	1.324	0.956
RFC Power Loom	VI	485.34	182.14	1443.00	985.35	717.55	112.96	13.63	(34.12)	1.947	1.329	0.968
LSC and Pit Loom	VII	463.88	203.87	1552.42	1042.16	746.50	4.61	(42.81)	(62.95)	2.094	1.406	1.000
LSC and C.R.Loom	VIII	478.13	203.00	1573.35	1063.30	766.50	(15.75)	(63.65)	(82.77)	2.123	1.435	1.034
RFC Spg+Pit Loom	IX	495.66	224.42	1608.32	1117.68	793.09	(125.27)	(119.02)	(109.79)	2.267	1.508	1.070
RFC Pedal Loom	X	516.21	206.13	1707.53	1182.39	873.11	(148.39)	(182.26)	(189.26)	2.304	1.595	1.178
ATDA Spg+Pit Loom	XI	592.77	249.42	1840.69	1219.64	861.97	(285.70)	(220.71)	(178.37)	2.484	1.646	1.163
KVIC Spg+Pit Loom	XII	728.61	308.03	3922.56	2905.33	2256.97	(2360.87)	(1903.78)	(1572.24)	5.293	3.920	3.045

Note: 1/ LC : Least Cost Composite Technology
2/ SB : Second Best Composite Technology
3/ ( ) : Figures in bracket are negatives
4/ LCS+SC: Least Cost Spinning(Indian) and Service Centre.

emerged as the most effecient technology . It is important to note here that at the expected productivity level, the relative decrease in PVC of the Japanese technology was not the lowest as was observed for modern spinning.
This is not due to the higher investment costs of the composite units,in fact the differential in investment costs compared to the least-cost have increased from 7.11 to 17.86 per cent than the spinning. Rather, the Japanese spinning had attained a high level of productivity compared to other spinning technologies. The PVC in excess of minimum of the least-cost and the second-best technologies is Tk.13.17 million, i.e it has increased by 12.95 per cent from the actual level of productivity. Therefore, the cost per additional job would increase from Tk.306.84 to Tk.346.58 thousand from the actual to the expected productivity level. This shows that if the modern composite technologies attain the expected level of productivity then the second-best technology would require an increase of 12.95 per cent to create additional job compared to the least-cost.

On the other hand, the PVCs of the ATDA Pedal spinning and Pit loom (rank X) and KVIC hand-spinning and Pit loom (rank XII) remain constant as the productivities at the expected and actual levels are identical. While for combined composite technologies between ranks V and IX, the differential in productivity only arises for the least-cost (Indian) and intermediate(RFC) unit. For the Service Centre and Power, Pit and C.R looms, the productivity level used is the observed or the actual level. The decrease in PVCs of these technologies (rank V to IX) would therefore, be due to higher level of productivity of the least-cost and RFC power spinning. At 15 per cent discount rate, the PVCs of the three successive attractive options i.e least-cost spinning, the Service Centre and Pit loom(rank V), RFC power loom composite unit (rank VI) and least-cost spinning and Pit loom (rank VIII) are Tk.981.17m, Tk.985.35m, and Tk.1,042.16 million respectively, which represent a decrease in PVC cost of 0.98,1.65 and 0.95 per cent respectively.Therefore,the RFC

power loom composite unit would increase its acceptability as an alternative at the expected production level compared to these technologies. This is evident from the costs per additional job incurred by these technologies in relation to the least-cost, which are about Tk.13.24 thousand, Tk.15.40 thousand and Tk.13.77 thousand respectively. Although, these costs have increased for technologies V and VII compared to the least-cost, but for RFC power loom composite unit (rank X) it has decreased at the expected productivity level. For the other options, the least-cost spinning and C.R loom (rank VII) and RFC Power spinning and Pit loom (rank IX), the PVCs are Tk.1,063.30 million and Tk.1,117.68 million indicating a decline of 0.93 and 1.90 per cent respectively from the actual productivity level. These decreases in PVCs enhance the acceptability of the RFC Power Spinning and Pit loom (rank IX), do not change the relative position of the least-cost spinning and C.R loom. Although, at the expected productivity level , the alternative technologies would be rendered as more attractive, however, the Indian composite unit would continue to be the least-cost composite technology.

Net Present Values (NPVs)

The profitability at the expected level of productivity increases for all modern composite and combined modern least-cost(Indian) and intermediate (RFC Power) spinning units. The ranking of the NPVs have been found to be identical to PVC ranking. The increase in profitability have been considered at 15 per cent capital cost. The NPVs of the least-cost and and the second-best composite technologies are Tk.177.36 million and Tk.164.35 million, which shows an increase in profitability of Tk.16.15m and Tk.14.31 million respectively compared to the actual productivity level. This rise in profitability could be related to the spinning where the net loss in NPV of the least-cost and second-best technologies had reduced by Tk.10.06m and Tk.7.91 million respectively. It, therefore, shows that the NPV differential between the least-cost and the second-best technologies at the expected productivity level have reduced by Tk.1.84m for the composite units and by Tk.2.15million for the spinning.

Therefore, , the variation in profitability of the composite technologies could be attributed to the diverse productivity levels of the spinning units. Similarly, the NPVs of the Japanese and the UK technologies of Tk.151.96million and Tk.90.6 million indicate an increase f Tk.13.06 million and Tk.13.86 million at the actual productivity level. The increase in profitability from the actual to the expected productivity level is narrow for modern technologies with the least-cost having the highest increase in NPV followed by the UK technology. The cost per additional job for the second-best technology compared to the least-cost has also increased from Tk.303.16 thousand to Tk.342.37 thousand at the expected productivity level. Therefore,if the productivity of the modern composite units attain their expected level,then the least-cost further increases in profitability, hence,making it more effecient than other modern alternatives.

Among the combined technologies, the NPVs of the ATDA Pedal spinning and Pit loom (rank X) and KVIC spinning and Pit loom (rank XII) remain the same as the expected and the actual productivity levels are identical. However, among the remaining technologies, the emphasis of the analysis would be on the three most attractive options i.e technology ranks V, VI and VII. The NPVs of the least-cost spinning, the Service Centre and Pit loom (rank V) and the RFC power loom composite unit (rank VI) are Tk.19.22 million and Tk.13.63 million respectively. The profitability at the expected productivity level has increased from Tk.9.4 million to Tk.19.22 million for technology V i.e by Tk.9.82 million, but the loss in NPV for each additional job compared to the least-cost increased from Tk.12.69 to Tk.13.72 thousand from the actual productivity level. On the other hand, the profitability of the RFC Power loom composite unit recovered from a loss of Tk.2.89 million to a surplus of Tk.13.63m i.e a net gain of Tk.16.52 million which is higher than the least-cost technology. The loss

per additional job has decreased marginally from Tk.15.55 thousand to Tk.15.51 thousand. Therefore, if the RFC composite unit achieves the expected productivity level, the net subsidy required at the actual level could be eliminated. However, in terms of employment expansion , this technology does not provide an alternative as it provides only 88 per cent employment of the least-cost spinning, the Service Centre and Pit loom (rank V) technology. The NPVs of the least-cost spinning and Pit loom (rank VII) at 10 and 15 per cent discount rates are Tk.4.61million and Tk.42.81 million respectively. At 10 per cent , the profitability increases from a net loss of Tk.11.04 million to a surplus of Tk.4.61 million, while at 15 per cent, the loss in NPV declines from Tk.52.86 million to Tk.42.81 million. Therefore, at 10 per cent discount rate, the practiced technology if combined with the least-cost spinning and Pit loom would not require any subsidy from other sectors of the economy. However, the cost per additional job at 15 per cent discount rate compared to the least-cost has increased from Tk.13.44 to Tk.13.83 thousand. The cost per additional job compared to the least-cost at the expected level of productivity would not affect the ranking of the technologies i.e V,VI and VII.Although the loss in NPV of the remaining techno logy ranks of VIII to X have decreased but these are not significant to make them attractive options. These technologies would require very high subsidies compared to the least-cost to create additional employment.

The economic effeciency of the alternative composite technologies would improve if they can attain the expected level of productivity, at which some of the options previously generating loss would yield surplus. The increase in productive effeciencies do not enhance the attractiveness of the ATDA Pedal and the KVIC hand-spinning, Pedal and Power looms and the traditional handlom, as the productivity measurement employed for these technologies have been based on actual observation from the survey. However, when some of

these technologies are combined with the least-cost and the RFC power spinnig, their effeciencies at the expected level increase; for example the RFC Power loom composite unit (rank VI) do not require any subsidy at 15 per cent capital cost, while the combined least-cost spinning and Pit loom (rank VII) generates surplus at 10 per cent discount rates. These are entirely due to the rise in effeciencies of the modern and the intermediate spinning. The effeciencies of the combined production technologies could,therefore, be improved if the modern or the intermediate sector spinning be operated effeciently. Higher level of effeciencies can also be achieved by the traditional sector if such measures as, the improvement of technology, organisation of production, introduction of an effecient net-work of distribution could be undertaken. The Indian technology emerges as the best option among the combined composite alternative despite its low productivity level. The comparative advantage of this technology lies in its low investment out-lay , which is 97.42, 93.36 and 76.77 per cent of the costs of the Rumanian, Japanese and the UK technologies. The most attractive option for employment expansion generate surplus at 10 per cent cost of capital only at actual productivity,however provides 8.05 times more employment than the least-cost technology.Finally,it emerges that the increase in productivity could bringforth more gains than the selection of options. If , for example, the productivity level of the second-best technology could be raised to the manufacturer's recommended level then there is a net increase of Tk.14.66 million , whereas the differential between the least-cost and the second-best technologies is Tk.11.55 million. In such circumstances, the selection of the second-best option would be more gainful as it would provide 38 per cent more employment and would also generate surplus at the expected level of productivity compared to the least-cost.

Present Value Cost Per Unit Output(PVC/Unit)

The present value cost per unit of all the alternatives have decreased from the actual to the expected productivity level , except for the ATDA Pedal spinning and Pit loom(rank XI) and the KVIC hand-spinning and Pit loom (rank XII). Table 7.9 gives the unit cost at three different discount rates of 10, 15 and 20 per cent for the alternative technologies. The PVC/Unit cost of the least-cost technology has decreased from Tk.1.61 to Tk.1.57; Tk.1.31 to Tk.1.11; and Tk.0.84 to Tk.0.83 at discount rates of 10, 15 and 20 per cent respectively. indicating a decrease in unit cost of 2.11, 1.94 and 1.65 per cent. Similarly, the unit cost of the second-best option have declined at the said discount rates by 1.90, 1.74 and 1.37 per cent. While for the Japanese unit the reduction in the PVC/Unit was by 1.64, 1.46 and 1.37 per cent and for the UK it was , 1.66. 1.44 and 1.37 per cent respectively. The decrease in unit cost of the least-cost technology at the expected productivity level was higher than other modern alternative technologies,followed by the second-best, while it was almost identical for the Japanese and the UK. Among the combined composite technologies, the decrease in the unit cost of technologies ranking between V to VII have been given emphasis. The unit cost of the least-cost spinning,Service Centre and handloom (rank V) at the expected productivity level have decreased by 1.06, 0.97 and 0.93 per cent at the three consequtive discount rates. Similarly, the unit cost of the RFC Power loom composite unit (rank VI) have declined by 1.72, 1.63 and 1.52 per cent respectively , while for the least-cost spinning and Pit loom these costs have decreased by 1.00, 0.98 and 1.67 per cent . Among the three combined technologies, the RFC Power loom composite unit has the highest reduction in unit costs at 10 and 15 per cent discount rates, while at 20 per cent , it is occupied by the least-cost spinning , Service Centre and Pit loom, As the least-cost composite technology has the highest reduction in unit cost at

the expected level of productivity , it is considered as relatively more effecient among the alternative technologies.

The increase in unit cost of the alternative technologies in relation to the least-cost at 15 per cent discount rate shows that the cost differential between the least-cost and the second-best have risen from 1.77 to 1.80 per cent from the actual to the expected productivity level. For the Japanese and the UK technologies, the differential in costs have increased from 2.65 to 3.15 per cent and 9.73 to 10.63 per cent respectively. This indicates that the unit cost differential of all the modern technologies have increased compared to the least-cost which corresponds to the earlier findings that the reduction in unit cost at different discount rates was higher for the least-cost among the modern composite alternatives. The reduction in unit cost and increase in cost differential is, however, not significant for the second-best technology. At the expected productivity level, the least-cost technology, therefore , becomes more effecient than the other modern composite units. On the other hand, the unit cost differential between the least-cost technology and the three combined composite options with employment expansion potentialities could be examined . The unit cost differential of the least-cost spinning, the Service Centre and Pit loom (rank V) compared to the least-cost composite technology has increased from 18.58 to 19.30 per cent. While for the RFC Power loom composite unit (rank VI) and the least-cost spinning and Pit loom (rank VII), these increases are from 19.46 to 19.72 per cent and 25.66 to 26.67 per cent respectively. Although the RFC composite unit with Power loom has the lowest increase , it is not substantial to change the ranking. Therefore, if the alternative composite technologies could be operated at the manufacturer's recommended or the expected productivity level, their effeciency could be increased by

reducing the unit cost. However, this increase in effeciency would not be sufficient to undermine the superiority of the modern composite technology, and the Indian technology source would remain to be the least-cost composite technology.

Sensitivity Analysis of Selective Composite Technologies

In this section the ranking of the alternative technologies has been re-appraised in the form of a sensitivity analysis. It has been established that the least-cost modern composite (Indian) technology is relatively more effecient than the other modern and combined alternatives viz. least-cost spinning, Service Centre and Pit loom, RFC composite unit with Power loom, least-cost spinning and Pit loom, etc. Therefore the re-appraisal or the sensitivity analysis would be concerned with selective composite technologies considered to be the most effecient . In the modern sector, these are the least-cost and the second-best composite units. While, from the combined composite technologies, the options established as attractive in terms of employment expansion are the least-cost spinning, Service Centre(rank V), the RFC power composite technology (rank VI) and the least-cost spinning and Pit loom . The sensitivity of these technologies would be evaluated by calculating the effeciency prices of the two major factor inputs i.e capital and labour. These estimates would be based on the information already available or the effeciency price already ascertained ——— for ——— unskilled labour and capital.

Adjustment of Factor Prices

For the effeciency price analysis, ——— an estimate of the scarcity or shadow price of the input-output is also essential, which could be a formidable task by itself . As the differential between the least-cost and the other alternative composite technologies is very significant, therefore, it is expected that the differentials would remain unchanged with factor prices adjustment. However, to examine this proposition, the effeciency pricing exercise whas purposely been restricted to a simple one. The effeciency prices would only be adjusted

for factor inputs viz. capital and labour. This could be justified by the fact that irrespective of technologies, the output prices received are identical, therefore any adjustment in output prices would be identical for all, hence invariant across the technologies.

Capital Cost

The capital or the investment cost has been adjusted for the foreign exchange component of the investment which comes only from the imported machinery and equipment. Construction and other costs are considered in the local currency. The investment cost is therefore, required to be adjusted for the modern and the intermediate technologies, except for the Power loom and traditional handloom which are entirely composed of domestic costs.The conversion of foreign exchange rate has been made at the official rate.It is therefore necessary to ascertain the effectiveness of this rate in estimating the opportunity costs of the foreign exchange component of the investment. This has been done by calculating the Shadow Exchange Rate (SER) using the formula taken from the UNIDO Monograph, 4/ and also the information provided in the table for input-output analysis of Bangladesh .5/ The shadow exchange rate calculated, shows that the cost of foreign exchange has been undervalued by about 20 per cent(see Appendix 7.2) While ,making effeciency price evaluation, the foreign exchange component of the investment would be adjusted accordingly.

Labour Cost

The labour costs of the modern and intermediate technologies have been used from the public sector wage-scale of the BTMC, but for the intermediate, the lower spectrum of these scales

4/ Guide to Practical Project Apprisal : Social Benefit-Cost Analysis in Developing Countries, UNIDO,New York,1978 p.48

5/ Input-Output Table for Bangladesh,Planning Commission, Government of Bangladesh,June 1980.

were taken. The wage rate for the KVIC spinning and the traditional handloom have been used from the actual wages paid to the spinners and weavers(See Wages and Salaries). For a new investment, the price effeciency appraisal usually estimates the opportunity costs of labour with the assumption that the labour would be drawn from other sectors of the economy. In developing countries, any surplus labour is assumed to be employed in the agriculture sector,therefore, the labour requirement for the investment would be drawn from this sector. The opportunity cost of the labour, is ideally the loss in output which caused by the withdrawl of this quantity of labour. Among the alternative technologies belonging to the modern, intermediate and traditional sectors evaluated here, the modern and the intermediate would require further expansion. The present question is as to whether the further expansion of spinning capacity should be done in the modern or the intermediate sector,and also whether the loom expansion should involve the modern auto or intermediate ordinary Power loom units or traditional handloom. Irrespective of the choice available, the expansion of either the modern or the intermediate spinning would draw labour from the agriculture sector. However, it could be argued that the expansion of the modern or the RFC Power loom weaving could result in the loss of production in the handloom sector. 6/ Therefore, the opportunity cost of labour for the spinning and the weaving may not be the same. The daily wages of the handloom weavers have been found to be Tk.13.06 and Tk.16.98 for the Pit and C.R looms respectively. The higher wage rate of the C.R loom weavers is due to their higher production level.As the Pit loom has been established as the most effecient among the handlooms, the daily wage rate of the Pit weavers is a matter of interest here. The wage rate of the Pit loom is about 67.5 per cent of the modern unskilled labour and 79.6 per cent of the intermediate sector. However, the calculation of the opportunity cost or the effeciency wage

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6/ At present,out of the total cloth consumption of 757 million yds(1981),the Handloom sector and the BTMC, including the Private sector meet 82 and 12 per cents of the consumption,while 6 per cent is imported. Moreover, about 40 per cent of the handloom is idle or some of them working on a part-time basis.(Cont. Page-78)

of the unskilled labour if drawn from the agriculture sector poses certain problems . But estimates made in related textile study to ascertain the economic wage rate of unskilled labour would be of use here. 7/ According to this study the economic wage rate of 1981 has been estimated to be Tk.10.56 per day (See appendix 7.3). Therefore, the economic wage rate of the unskilled labour represents about 81, 65 and 55 per cent of the Pit loom, intermediate and modern sector wage rates. It has been assumed that the daily wage rate of the Pit loom would represent the opportunity cost of labour for the weaving sector, while for the spinning , the economic wage rate calculated would be used for the modern and the intermediate technologies. Therefore for effeciency analysis, the adjustment of the unskilled labour wages would made by factors 0.55 and 0.68 for the modern spinning and weaving, while for the intermediate, by factors 0.65 and 0.8 respectively. For the combined composite unit, the Pit loom wages no adjustment would be made, therefore the wages found would be used.

Ranking of Selective Composite Alternatives According to the Effeciency Pricing of the Factor-Inputs

Table 7.10 shows the ranking of the selective alternative composite technologies after the adjustment of factor prices have been made. Although the effeciency of the individual technology increases at the expected productivity level but the ranking remains unaffected. Therefore, re-appraisal at the actual productivity level would alone serve the examination of the sensitivity of ranking of the alternative technologies. It also appears from the table that the ranking of the least-cost and the second-best technologies remain unchanged . However, in the intermediate and traditional sector, the RFC composite unit with Power loom (previously ranked VI) which ranked next to the least-cost spinning ,Service Centre and Pit loom in terms of effeciency , emerged as more effecient than the former. But at the same time , the ranking

7/ Feasibility Study for a Textile Finishing Plant in Tongi,Bangladesh by Nederland Economic Institute, Nederland,Dec.,1980 pp. 87 and A14.

TABLE 7.10

PVC,NPV AND PVC/UNIT OF SELECTIVE COMPOSITE TECHNOLOGIES

AT EFFICENCY FACTOR PRICES AND ACTUAL PRODUCTIVITY

(In Million Taka)

Technologies	Ranking	Total Capital Cost	Annual Operating Cost	PVC at Discount Rates			NPV at Discount Rates			PVC/Unit at Discount Rates(in Taka)		
				10%	15%	20%	10%	15%	20%	10%	15%	20%
Modern												
INDIAN(LC)[1]	I	441.22	136.94	1,203.85	853.13	643.06	355.36	147.01	40.79	1.624	1.151	0.868
RUMANIAN(SB)[2]	II	453.39	138.00	1,219.70	865.47	653.10	339.93	134.82	30.80	1.646	1.168	0.881
Modern/Intermediate/Traditional												
RFC Power Loom	III	451.05	170.77	1,382.78	949.54	695.20	173.18	49.44	(11.77)[3]	1.865	1.281	0.938
LSC+SC+Pit[4] Loom	IV	500.70	184.42	1,466.44	996.02	721.58	93.22	4.37	(37.58)	1.978	1.343	0.973
LSC and Pit Loom	V	464.50	203.37	1,565.44	1,054.34	757.64	(8.10)	(54.78)	(73.95)	2.112	1.423	1.022

Note: 1/ LC : Least Cost Composite Technology
2/ SB : Second Best Composite Technology
3/ ( ) : Figures in bracket are negatives
4/ LSC+SC: Least Cost Spinning(Indian) and Service Centre.

of the least-cost spinning and Pit loom would remain constant.

Therefore, the adjustment of factor prices would not change the relative superiority of the modern sector , i.e the least-cost spinning and the second-best technologies. They would continue to be the best alternatives when economic effeciency or surplus generation is the prime objective of the choice. Yet, in terms of employment expansion, the intermediate (RFC) composite unit appears to be an attractive option,the comparative advantage of which lies in its use of local power loom machinery and large savings from wage bill by using economic wage rate. It would be worthwhile to examine the changes in PVC, NPV and PVC/Unit at the effeciency prices of the selective technologies,and the ensuing analysis would be based on 15 per-cent discount rate.

PVC, NPV and PVC/Unit of Selective Composite Technologies

The PVC of the least-cost and the second-best technologies at effeciency prices are Tk.853.13 million and Tk.865.47 million , indicating an increase in PVCs by 17.88 and 17.48 per cent respectively over the market prices of the factor . inputs. The PVC of the RFC composite unit with Power loom (rank V), least-cost spinning, Service Centre and Pit loom(rankVI) and the least-cost spinning and Pit loom(rank VII) are Tk.949.54 million, Tk.996.02m and Tk.1,054.34 million respectively. There is a decrease in the PVC of rank V by 5.22 per cent ,while for technologies rank VI and VII, the PVCs have increased marginally by about 0.51 and 0.2 per cent respectively. On the other hand, the PVC differential between the least-cost and the second-best technologies remained almost unchanged. Compared to the least-cost technology, the PVC differential of the RFC Power loom Composite unit decreased from 19.42 to 11.30 per cent,while for least-cost spinning,Service Centre and Pit loom , these differentials have increased marginally from 18.12 per cent to 16.74 and 25.42 to 23.58 per cent respectively. The only significant change in PVC have taken place for the RFC composite unit, which, however, is not sufficient to change the relative superiority of the least-cost (Indian) technology.

The change in the NPV would correspond with the PVC changes. Table 7.10 shows that the NPV of the least-cost and the second-best technologies are Tk.147.01million and Tk.134.82 million. Compared to the NPV at market price, they have decreased by Tk.14.2million and Tk.14.87 million respectively. The NPV of the RFC Power loom composite unit has increased from a loss of Tk.2.89 million to a net surplus of Tk.49.44 million. While the NPV of the least-cost spinning, Service Centre and Pit loom technology declined from Tk.9.45m to Tk.4.37 million, and for the least-cost spinning and Pit loom technology, the loss in NPV has increased from Tk.52.86 m to Tk.54.78 million. Therefore, the loss in NPV of the RFC Power loom composite unit per additional job compared to the least-cost technology would decline from Tk.15.55 to Tk.8.16 thousand making it more attractive than the other two combined composite technologies. Although the RFC technology would no longer require any subsidy per job , it would still incur cost in terms of loss in surplus compared to the least-cost.

Finally, the PVC/Unit of the selective composite technologies could be examined at the estimated effeciency price , at which the unit cost of the least-cost and the second-best technologies increase by 16.78 and 17.42 per cent respectively from their market prices. The PVC/Unit of the RFC composite unit with Power loom ,however, has decreased by 5.18 per cent, while for the least-cost spinning ,Service Centre and Pit loom (rank VI) and the least-cost spinning and Pit loom(rank VII),the unit costs have increased marginally by 0.45 and 0.21 per cent respectively. The unit cost differential of the least-cost technology compared to the second-best remained almost unchanged, but for technology ranks V and VI, it has increased marginally by 1.43 and 1.81 per cent respectively. On the other hand,the unit cost differential of the RFC composite unit with Power loom has decreased by 8.06 per cent. The relative decline in unit cost is substantial for the RFC composite unit with Power loom to be an attractive option, yet , still the unit cost of the least-cost technology is about 11.30 per cent less.

It is worth mentioning that the adjustment in capital and labour costs made is not a very detailed one. A detailed effeciency pricing analysis would have required the exclusion of all taxes, duties and subsidies from the investment costs and also the adjustment of all imported components of the investment costs with the economic exchange rate. However, this study did not undertake such excercise as the least-cost and the second-best technologies are highly effecient compared to their alternatives. If the taxes and duties were excluded before adjusting the foreign currency component of the investment then the PVC, NPV and PVC/Unit of the least-cost and the second-best technologies would have improved relatively making them appear more attractive by increasing their effeciency. The other important feature which deserves special attention here is the improvement of the RFC composite unit with Power loom over the combined least-cost spinning, Service Centre and Pit loom. The RFC composite technology has about 90 per cent employment of the least-cost spinning, Service Centre and Pit loom yet at the same time requires an investment cost which is 10 per cent less than the latter. Consequently, the profitability of the RFC composite technology increases by Tk.45.07 million. Therefore, at effeciency prices of factor inputs, the RFC composite unit with Power loom would be the most attractive option if employment expansion is the objective. However, it would have a loss in NPV of Tk.97.57 million but has the potential increase in employment of about 7.20 times more than the least-cost technology.

6/ (Cont. Page-73). Therefore, it could be argued that if the per capita consumption of cloth remains constant, then any increase in production in the modern or private sector would give rise to loss in production in the handloom sector. But, this would not be the case if increase in per capita cloth consumption is the objective, then such increase could be achieved in the modern or private sector without affecting the output of the handloom sector.

APPENDIX 7.1

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]LIST

10  REM    CALCULATION OF NPV
20  REM    FOR ALTERNATIVE TECHNOLOGIES TO PRODUCE A FIXED CLOTH OUTPUT
22  DIM X(24)
25  HOME
30 SV = 0:S1 = 0:S2 = 0:S3 = 0:S4 = 0:YR = 1
35 P1 = 0:P2 = 0:P3 = 0:P4 = 0:Z1 = 0
40  IF YR >  = 6 THEN  GOTO 70
45  PRINT : PRINT
50  PRINT "ENTER REVENUE FOR YEAR ";YR
60  PRINT "WASTAGE=": INPUT W: PRINT "OUTPUT=": INPUT G: PRINT "PRICE=": INPUT
    P
62 R = W + G + P
64  PRINT "REVENUE IS: ";R;" FOR YEAR ";YR
70  IF YR = 23 THEN  GOTO 300
80  PRINT "ENTER IC FOR YEAR ";YR
90  INPUT IC
100  IF YR >  = 7 GOTO 130
110  PRINT "ENTER OC FOR YEAR ";YR
120  INPUT OC
130 X(YR) = R + SV - IC - OC
135  PRINT "CASH FLOW IS ";X(YR);" FOR YEAR ";YR
140 F1 = X(YR) / (1.1 ^ YR)
145 P1 = P1 + ((IC + OC)) / (1.1 ^ YR)
150 F2 = X(YR) / (1.14 ^ YR)
155 P2 = P2 + ((IC + OC)) / (1.14 ^ YR)
160 F3 = X(YR) / (1.15 ^ YR)
165 P3 = P3 + ((IC + OC)) / (1.15 ^ YR)
170 F4 = X(YR) / (1.2 ^ YR)
172 P4 = P4 + ((IC + OC)) / (1.2 ^ YR)
174 Z1 = Z1 + G
175  PRINT
180  PRINT "DCF10 = ";F1;"  YEAR = ";YR
182  PRINT "DCF14 = ";F2;"  YEAR = ";YR
184  PRINT "DCF15 = ";F3;"  YEAR = ";YR
186  PRINT "DCF20 = ";F4;"  YEAR = ";YR
190 S1 = S1 + F1
200 S2 = S2 + F2
210 S3 = S3 + F3
220 S4 = S4 + F4
230 YR = YR + 1
240  IF YR < 24 THEN  GOTO 40
245  PRINT : PRINT "***NPV VALUES***"
250  PRINT "NPV10 = ";S1
251  PRINT "NPV14 = ";S2
252  PRINT "NPV15 = ";S3
253  PRINT "NPV20 = ";S4
254  PRINT
255  PRINT "TOTAL DISC.IC+OC= ";P1;"AT 10% AND OUTPUT= ";Z1;" PVC = ";P1 /
     Z1;" PER UNIT"
256  PRINT "TOTAL DISC.IC+OC= ";P2;"AT 14% AND PVC= ";P2 / Z1;"PER UNIT"
257  PRINT "TOTAL DISC.IC+OC= ";P3;"AT 15% AND PVC= ";P3 / Z1;"PER UNIT"
258  PRINT "TOTAL DISC.IC+OC= ";P4;"AT 20% AND PVC= ";P4 / Z1;" PER UNIT"
260  PRINT "SEARCH FOR NPV=0?": GET A$
270  IF A$ <  > "N" GOTO 400
280  END
300  PRINT "ENTER SALVAGE VALUE:"
310  INPUT SV
320  GOTO 80
400  HOME : PRINT "SEARCH FOR NPV=0": PRINT : PRINT
405 S5 = 0
410  PRINT "ENTER DISCOUNT RATE?": INPUT Z
420  FOR YR = 1 TO 23
430 F5 = X(YR) / ((1 + Z / 100) ^ YR)
440 S5 = S5 + F5
450  NEXT YR
460  PRINT "NPV AT ";Z;"% DISCOUNT RATE IS ";S5
470  PRINT "REPEAT? Y OR N": GET A$
480  IF A$ <  > "N" THEN  GOTO 405
490  GOTO 290
```